Revised Curricula & Syllabi
Of

"Bachelor of Science (Hons.) in Agriculture"

(A degree program)

SEMESTER SYSTEM (w. e. f. 2018-19)

Bundelkhand University, Jhansi

Kanpur Road, Jhansi, Uttar Pradesh (India)

Bundelkhand University, Jhansi (India) UP

Dated: 23/01/2018

माननीय कुलपति जी के आदेशानुसार पत्रांक संख्या बु० वि० /एके० /2018**/ 14188-90** दिनांक 09/01/2018 के अनुपालन में दिनांक 23/01/2018 को पूर्वाह्न 11:30 बजे विश्वविद्यालय सभागार में कृषि संकाय की समस्त पाठ्यक्रम समितियों की बैठक आहूत की गई, जिसमे एजेंडा संख्या -1 के अन्तर्गत लिखित "पाठ्यक्रम संरचना" - विश्वविद्यालय अनुदान आयोग की गाइड लाइन के अनुरूप पाठक्रमों का अधुनातन किया जाना सहित पाठ्यक्रम की गुणवत्ता पर विशेष ध्यान दे पाठ्यक्रम को तैयार करना था /

बैठक की कार्यवाही -

"कृषि संकाय" की समस्त पाठ्यक्रम समितियों के समन्वयक एवं सदस्य आज दिनांक 23/01/2018 को अधुनातित कृषि स्नातक पाठ्यक्रम की संरचना का विस्तृत ड्राफ्ट (2nd संशोधन के उपरान्त) अपनी संस्तुति सहित सत्र 2018-19 से लागू करने हेतु तैयार आगे की कार्यवाही के लिए "कृषि संकाय अध्यक्ष", बुन्देलखंड विश्वविद्यालय, झाँसी को सौंपती है /

समस्त पाठ्यक्रम समितियों के समन्वयकों एवं सदस्यों के हस्ताक्षर-

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Bundelkhand University, Jhansi (India) UP

Dated: 23/01/2018

माननीय कुलपति जी के आदेशानुसार पत्रांक संख्या बु० वि० /एके० /2017/ दिनांक 04/03/2017 के अनुपालन में दिनांक 08/03/2017 को पूर्वाह्न 11:30 बजे विश्वविद्यालय सभागार में कृषि संकाय की समस्त पाठ्यक्रम समितियों की बैठक आहूत की गई, जिसमे एजेंडा संख्या -1 के अन्तर्गत लिखित "विश्वविद्यालय अनुदान आयोग की गाइड लाइन के अनुरूप पाठक्रमों का अधुनातन किया जाना सहित पाठ्यक्रम की गुणवत्ता पर विशेष ध्यान दे पाठ्यक्रम को यूनिट बार करना था" /

बैठक की कार्यवाही में समिति के सदस्यों ने कृषि संकाय अध्यक्ष्य के सम्मुख विषय पर अपने विचार रखते हुए कहा कि -

कृषि एवम कृषक कल्याण मंत्रालय, भारत सरकार के "कृषि अनुसन्धान एवम शिक्षा विभाग" (DARE) के स्वायत्त-शासित संगठन "भारतीय कृषि अनुसन्धान परिषद्" (ICAR), नई दिल्ली जो कि एक उच्च स्तरीय संस्था है और सम्पूर्ण भारत में कृषि शिक्षा एवम अनुसन्धान की दिशा एवम प्रबंधन सुनिश्चित करती है की " 5th कृषि संकाय अध्यक्षों की समिति " ने विश्वविद्यालय अनुदान आयोग की संस्तुतियों को समाहित करते हुए भारत के सभी केंद्रीय कृषि विश्वविद्यालयों, राज्य कृषि विश्वविद्यालयों एवम कृषि डीम्ड विश्वविद्यालयों के कृषि स्नातक एवम परास्नातक पाठ्यक्रमों को अधुनातन करने की संस्तुति की हैं तथा कृषि स्नातक उपाधि को प्रोफेसनल उपाधि घोषित किया है / और उपरोक्त के अनुपालन में भारत के सभी केंद्रीय कृषि विश्वविद्यालय, राज्य कृषि विश्वविद्यालय एवम कृषि डीम्ड विश्वविद्यालय अपने कृषि स्नातक एवम परास्नातक पाठ्यक्रमों को अधुनातित कर रहे हैं अर्थात हमें भी अपने विश्वविद्यालय में उक्त की संस्तुतियों को समाहित करते हुए कृषि स्नातक के पाठ्यक्रम को अधुनातित कर लेना करना चाहिए जिससे कि पाठ्यक्रम एवम उपाधि में समरूपता बनी रहे, यदि हम ऐसा नहीं करते हैं तो हमारे विश्वविद्यालय के छात्रों को भविष्य में कठिनाइयो का सामना करना पड़ सकता है / (विस्तृत जानकारी के लिए 5th कृषि संकाय अध्यक्षों की समिति की प्रतिवेदन के मुख्य अंश देखें)

बैठक के अंत में उपरोक्त विषय पर सभी सदस्यों ने अपनी सहमति व्यक्त की और सर्वसम्मति से प्रस्ताव पारित किया कि बुन्देलखण्ड विश्वविद्यालय के अन्तर्गत संचालित कृषि स्नातक पाठ्यक्रम को उपरोक्त 5th कृषि संकाय अध्यक्षों की समिति की संस्तुतियों को समाहित करते हुए अधुनातित किया जाये / इसके लिये एक कृषि संकाय अध्यक्ष कि अध्यक्षता में समिति का गठन भी किया गया जो कि कृषि स्नातक के अधुनातित पाठ्यक्रम के **विस्तृत प्रारूप** को तैयार करके दिनांक 10/03/2017 को कृषि संकाय अध्यक्ष को सौंपेगे, जिससे कि उसे आगामी पाठ्यक्रम समिति की बैठक में उचित एवम आवश्यक संशोधन हेतु प्रस्तुत किया जा सके /

<u>समिति की संरचना</u> -

समिति के अध्यक्ष श्री. मदन मोहन राजपूत, (कृषि संकाय अध्यक्ष)

समिति के सचिव डॉ. नरेश कुमार सिंह, (एसोशिएट प्रोफेसर)

समिति के सदस्य डॉ. वरुण कुमार सिंह, (एसोशिएट प्रोफेसर)

समिति के सदस्य डॉ. सरजू नारायण, (असिस्टेंट प्रोफेसर)

समिति के सदस्य प्रो० बी० गंगवार (समन्वयक, कृषि संस्थान, बी० यू०)

उपरोक्त समिति अपने कर्तव्यों का निर्वहन करते हुए आज दिनांक 23/01/2018 को अधुनातित कृषि स्नातक पाठ्यक्रम का विस्तृत ड्राफ्ट (2nd संशोधन के उपरान्त) तैयार करके कृषि संकाय अध्यक्ष, बुन्देलखंड विश्वविद्यालय, झाँसी को सौंपती है /

संलग्नक :- अधुनातित कृषि स्नातक पाठ्यक्रम का विस्तृत प्रारूप /

हस्ताक्षर समिति अध्यक्ष :- (हस्ताक्षर समिति सचिव)

हस्ताक्षर समिति सदस्य :-

हस्ताक्षर समिति सदस्य :-

हस्ताक्षर समिति सदस्य :-

Preamble

The quality of human resource is the greatest treasure of a nation and the main driver of comprehensive development. Drucker (1994) said "Instead of traditional factors of production land, labor and capital – knowledge and technology will become the critical factors. The winners will be the economies with necessary skills and the losers will be nations who lack them". Therefore our human capital has to respond to emerging challenges. But, fundamental question is that ***"What kind of Agricultural education is needed for what kind of Society of tomorrow"*** *In this regard the aim, process and goal of agriculture education would have to be identified while preparing educational program for 21st century. Agriculture education is a profession oriented complex built on knowledge from basic sciences, applied sciences most relevant to agriculture production, related insight from the social & behavioral sciences and the problem solving field like natural resources management also.*

The emerging scenarios and diverse employment opportunities warrant curricular reform through better course integration. The urgent need to Under Graduate Agricultural education is to enhance the skills and problems solving abilities. There is a need for a few balances between breadth of discipline oriented studies and the depth of specialized skills & abilities. The integrated four year curriculum an appropriate balance between breadth and specialization, discipline courses v/s multidisciplinary courses, core courses v/s choice of specialization and class room study v/s field/factory study. Conferring professionalism in a chosen area should be the mail consideration. Since education and training are powerful tools for agriculture development and training should find a higher place in higher educational agenda. The training with education should focus on practical and problem solving abilities and acquisition of skills for entrepreneurship and self employment.

Hence, toward enhancing human values & ethics, personality & leadership attributes, employability and entrepreneurial ability of the Agriculture graduates we decides to upgrade/revised curriculum of Agricultural education at graduate levels accordingly.

Secretary

(Draft Committee)

Contents List

1: Ordinances-2017-18

"Bachelor of Science (Hons.) in Agriculture" Ordinance : 2017-18

These ordinances shall be called ***"The Bundelkhand University, Jhansi, Bachelor of Science (Hons.) in Agriculture degree Ordinance 2017-18"*** . These ordinances shall replace the existing ordinances and effective from the Academic Session 2018-19. The ordinance has been grouped into following parts:

1. Nomenclature of the degree 2. Academic year and fees 3. Admission eligibility and procedures
4. Program duration 5. Examination & evaluation .

1. Nomenclature of the degree:

The name of the degree shall be ***Bachelor of Science (Hons.) in Agriculture*** and abbreviated in short as ***B. Sc. (Ag.) Hons.***

2. Academic year and fees:

Academic year will be divided into two semester having duration of approximately 20 weeks each. Students will have to pay fee as prescribed under rules and regulations of the Bundelkhand University, Jhansi and/or Colleges for the program at the time of admission.

3. Admission procedure and eligibility:

3.1 Procedure of admission: Admission to the first year in the program will be made on the basis of merit obtained by candidate in a competitive entrance examination conducted by an admission committee of the University/College under the supervision of the Dean faculty of Agriculture, Bundelkhand University, Jhansi.

3.2 Eligibility of admission: The all residents of India and NRI's will be eligible for admission in this program provided that candidate must be physically fit and passed / appeared in the qualifying examination i.e. Intermediate (10+2) examination in Agriculture or Science (with Zoology, Botany and Chemistry) stream, should have minimum second division and has not crossed 21 years of age on 1st July of that academic year. The admitted students have to submit all original documents related to their admission eligibility before 4:00 PM on dated 30th September of that academic session. If fail to submit, their admission liable to cancel without pre notice to the candidate.

3.3 Number of seats and reservation: Total number of seat available for admission in the university/colleges will be published by the University every year before initiation of admission process. The reservation in the admission will be applicable as per the rules & regulation of reservation formulated by university and/or state Government of Uttar Pradesh / Government of India.

4. Program duration:

It shall be a four years (eight semesters) program and extended to a maximum of consecutive up to six years (12 semesters). The duration of semester will be 20 weeks with at least 105 instruction days and each academic year would consist of two semesters.

5. Examination and evaluation :

5.1 : Examination Pattern-

A:- Examination Pattern of 1st , 2nd , 3rd , 4th , 5th , and 6th semesters	
S. No.	**Exam Pattern**
1	**There shall be two component in the examination for evaluation of students namely:-** **(A) Theory** : ***[*** *Midterm Exam (M) + Final Exam (T)* ***]*** **(B) Practical :** ***[*** *Practical Exam (P)* ***]*** **Note:- (i)** The ***Midterm Exam (M)*** shall be internal in nature and conducted by *"Internal examiner"* (approved teacher of the subject) of the college/institute, where students are admitted. "Mid Term" exam will be of minimum 10 to maximum 20 questions and generally cover about 50% of the total syllabus. And student has to deposit fee Rs. 100=00/semester in the college/institute at the time of registration in the semester in head of "internal examination fee" to meet out the cost of stationary required . (ii) The ***"Final Exam"*** and "***Practical Exam"*** shall be conducted by the University at the end of semester as per their examination's rules and regulation.
2	**Marks Distribution :-** **(A) Courses/Papers with Theory and Practical both :-** Mid-term Exam (20%) + Practical (30%) + Final Exam (50%) = 100%
	(B) Courses/Papers with only Theory (without Practicals) :- Mid Term Exam **[**Objective Type (20%) + Assignment(20%)**]** **+** Final Exam (60%) = 100% **(Note:** Where, there is no credit hours for practical in the paper "Mid Term" exam shall be include 50% **"Assignment"** out of total "Mid term" marks and then marks Combine together.

B:- Examination Pattern for :- 7th & 8th semester (4th Year)		
S. No.	**Evaluation Parameters for both semesters**	**Marks**
1	Project Planning & Writing	10%
2	Presentation	10%
3	Regularity	10%
4	Monthly Assessment	10%
5	Output Delivery	10%
6	Technical Skill Development	10%
7	Entrepreneurship Skill	10%
8	Business Networking Skills	10%
9	Report Writing Skills	10%
10	Final Presentation	10%
	Total Marks for:- 7th - Semesters-	**100**
	8th - Semesters-	**100**
	Minimum attendance requirement for both semesters-	**85%**

Note: There will be a committee for successful function & regulation of 7th & 8th semester. The committee will have following members-

1. Chairperson, (Principal of the College/Director of the Institution)

2. Program Coordinator, (A faculty teacher appointed by Principal/ Director of the Institution).

3. Program Officers, (At least one teacher from each subject of specialization)

This committee will be responsible for implementation & evaluation of the program according to the curriculum & performance of the students.

5.2: Evaluation method-

<table>
<tr><td>S.No.</td><td colspan="3"><u>Calculation & Evaluation of GPA / CGPA / OGPA</u></td></tr>
<tr><td rowspan="9">1</td><td>Percentage(%) of marks obtained</td><td colspan="2">Conversion into Points(10) Scale</td></tr>
<tr><td>100</td><td colspan="2">10</td></tr>
<tr><td>90 to less than 100</td><td colspan="2">9 to less than 10</td></tr>
<tr><td>80 to less than 90</td><td colspan="2">8 to less than 9</td></tr>
<tr><td>70 to less than 80</td><td colspan="2">7 to less than 8</td></tr>
<tr><td>60 to less than 70</td><td colspan="2">6 to less than 7</td></tr>
<tr><td>50 to less than 60</td><td colspan="2">5 to less than 6</td></tr>
<tr><td>Less than 50 (Fail)</td><td colspan="2">less than 5</td></tr>
<tr><td colspan="3">Minimum passing criteria:
(i) The passing “Grade point” for a paper shall be minimum five (5.00), provided that both components of exam (Theory & Practical independently) should have minimum 33% marks, otherwise shall be declare as “Back Paper” for re-examination in all the steps of examination of that paper.(Theory = Mid term + final theory)
(ii) Further, student must be appear in all the steps of the examination i.e. Mid term, Assignment, Practical and final theory examination as applicable, if he/she fail to appear in any step of examination shall be declare as “Back Paper” for re-examination in all the steps of examination of that paper.
(ii) A student who maintains or fail to maintain the minimum passing criteria, as above, at the end of first semester of the academic year will be promoted to the second semester of that academic year, if he passes in minimum 50% credit hours (excluding non grade credit hours) of that semester.
(iii) Further, students will be required to pass at least 50% credit Hours (excluding non-grade credit hours) in both semesters of an academic year for promotion of next year registration.</td></tr>
<tr><td rowspan="5">2</td><td>OGPA</td><td>Grade</td><td>DIVISION</td></tr>
<tr><td>5.000 – 5.999</td><td>D</td><td>Pass</td></tr>
<tr><td>6.000 – 6.999</td><td>C</td><td>II/2nd division</td></tr>
<tr><td>7.000 – 7.999</td><td>B</td><td>I/1st division</td></tr>
<tr><td>8.000 and Above</td><td>A</td><td>I/1st division with distinction</td></tr>
<tr><td>3</td><td colspan="3"><u>Calculation of GPA / CGPA / OGPA :-</u>

Point Score of the paper = Marks obtained out of 100 x Credit Hours / 10

GPA = Total Point Score in all papers / Total Credits (for one semester)

CGPA = ∑ Total Point Score / Course Credits

OGPA = ∑ Total Point Score (after excluding failure Points) / Course Credits

% of Marks = OGPA X 100 / 10</td></tr>
<tr><td>4</td><td colspan="3">Total Credit Hours For CGPA calculation- 174</td></tr>
</table>

2: Course curricula

General Information at a glance

(A) Nomenclature of UG degree :- B. Sc. (Ag.) Hons.
(A professional degree)

(B) Duration of Program:- Minimum : 8 Semesters (4-Years)
Maximum : 12 Semesters (6-Years)

(C) Admission eligibility criteria :- 10+2 or intermediate with Agriculture, PCB from a recognized Board.
(P - Physics, C - Chemistry, B – Biology)

(D) Medium of Instruction :- English / Hindi

(E) "Rural Entrepreneurship Awareness Development Yojana" *(READY)* :-

(i) *It shall be an essential & prerequisite one year program (7^{th} & 8^{th} semesters / final year) for the award of* ***B. Sc. (Ag.) Hons.*** *degree to ensure hands on experience & practical training.*

(ii) ***The program "READY" would require additional financial assistance for it successful implementation and for the same students has to deposit Rs. 2,000=00 additional fee at the time of 4^{th} year's admission in the respective college/institute.***

(F) Total Credit Hours of The Program:-

(a) Core courses (125) + Electives (09) + READY (40) = 174 (Credits for Grade Calculation)
(b) Human Values & Ethics and NSS / NCC / Rovers Rangers / Physical Education & Yoga and Educational tour = 14* (*Non Grade credits)

Total Credit Hours = 188

Table- 1 : Curriculum of :- 1st - Semester (1st –Year)

S. No.	Paper Code	Course/Papers Title	Credit Hours
1		Fundamental of Plant Biochemistry & Physiology	3 (2+1)
2		Fundamental of Soil Science	3 (2+1)
3		Fundamental of Agronomy	3 (2+1)
4		Fundamental of Horticulture	2 (1+1)
5		Introduction of Forestry	2 (1+1)
6		Rural Sociology & Education Psychology	2 (2+0)
7		Agricultural Heritage	2 (2+0)
8		Comprehension & Communication English	1 (1+0)
9		Statistical Methods	2 (1+1)
		Total grade Credit Hours:	**20 (14+6)**
***Non grade courses - 1. Human Values & Ethics :**			**1**
2. NSS / NCC / Rovers Rangers / Physical Education & Yoga :			**1**
Total Credit Hours in the semester = 20 + 2* = 22			

Table- 2 : Curriculum of :- 2nd - Semester (1st –Year)

S. No.	Paper Code	Course/Papers Title	Credit Hours
1		Fundamental of Genetics	3 (2+1)
2		Agri-Informatics	2 (1+1)
3		Introductory Soil & Water Conservation	2 (1+1)
4		Fundamental of Biotechnology	2 (1+1)
5		Fundamental of Agricultural Economics	2 (2+0)
6		Fundamental of Plant Pathology	3 (2+1)
7		Fundamental of Entomology	3 (2+1)
8		Fundamental of Agricultural Extension Education	3 (2+1)
9		Communication Skills & Personality Development	2 (1+1)
		Total grade Credit Hours:	**22 (14+8)**
***Non grade courses - 1. Human Values & Ethics :**			**1**
2. NSS / NCC / Rovers Rangers / Physical Education & Yoga :			**1**
Total Credit Hours in the semester = 22 + 2* = 24			

Table- 3 : Curriculum of :- 3rd - Semester (2nd –Year)

S. No.	Paper Code	Course/Papers Title	Credit Hours
1		Crop Production Technology-I *(Kharif Crops)*	4 (1+3)
2		Fundamental of Plant Breeding	3 (2+1)
3		Agriculture Finance & Cooperation	3 (2+1)
4		Soil Microbiology	2 (1+1)
5		Farms Machinery & Power	2 (1+1)
6		Production Technology for Vegetable & Spices	2 (1+1)
7		Environmental Studies & Disaster Management	3 (2+1)
8		Livestock & Poultry Management	3 (2+1)
9		Renewable Energy & Green Technology	1 (1+0)
		Total grade Credit Hour	**23 (13+10)**
***Non grade courses - 1. Human Values & Ethics :**			**1**
2. NSS / NCC / Rovers Rangers / Physical Education & Yoga :			**1**
Total Credit Hours in the semester = 23 + 2* = 25			

Table- 4 : Curriculum of :- 4th - Semester (2nd –Year)

S. No.	Paper Code	Course/Papers Title	Credit Hours
1		Crop Production Technology-II *(Rabi Crops)*	4 (1+3)
2		Production Technology for Ornamental Crops, MAP & Landscaping	2 (1+1)
3		Problematic Soils & their Management	2 (2+0)
4		Production Technology for Fruits & Plantation Crops	2 (1+1)
5		Principles of Seed Technology	3 (2+1)
6		Farming System & Sustainable Agriculture	1 (1+0)
7		Agricultural Marketing, Trade & Prices	3 (2+1)
8		Introductory Agro-meteorology & Climate Change	2 (1+1)
9		Dairy Science	3 (2+1)
10		**Elective Course** (any one course from the list given below)	3 (2+ 1)
		Total grade Credit Hours:	**25 (15+10)**
***Non grade courses - 1. Human Values & Ethics :**			**1**
2. NSS / NCC / Rovers Rangers / Physical Education & Yoga :			**1**
Total Credit Hours in the semester = 25 + 2* = 27			

Table- 5 : Curriculum of :- 5th - Semester (3rd –Year)

S. No.	Paper Code	Course/Papers Title	Credit Hours
1		Principles of Integrated Pest Management	3 (2+1)
2		Manures, Fertilizers & Soil Fertility Management	3 (2+1)
3		Pest of Crops and Stored grain & Their Management	3 (2+1)
4		Disease of Field and Horticultural Crops & Their Management-I	3 (2+1)
5		Crop Improvement-I *(Kharif Crops)*	2 (1+1)
6		Entrepreneurship Development & Business Communication	2 (1+1)
7		Geo-informatics and Nano-technology and Precision Farming	1 (1+0)
8		Intellectual Property Right	1 (1+0)
9		**Elective Course** (Non repeat one course from the list given below)	3 (2+ 1)
		Total grade Credit Hours:	**21 (14+7)**
***Non grade courses - 1. Human Values & Ethics :**			**1**
2. NSS / NCC / Rovers Rangers / Physical Education & Yoga :			**1**
Total Credit Hours in the semester = 21 + 2* = 23			

Table- 6 : Curriculum of :- 6th - Semester (3rd –Year)

S. No.	Paper Code	Course/Papers Title	Credit Hours
1		Rainfed Agriculture& Watershed Management	2 (1+1)
2		Protected Cultivation & Secondary Agriculture	2 (1+1)
3		Disease of Field & Horticulture Crops & Their Management-II	3 (2+1)
4		Post Harvest Management & Value Addition of Fruits & vegetables	2 (1+1)
5		Management of Beneficial Insects	2 (1+1)
6		Crop Improvement- II *(Rabi Crops)*	2 (1+1)
7		Principle of Organic Farming	2 (1+1)
8		Farm Management, Production & Resource Economics	2 (1+1)
9		Dairy Products Manufacturing Technology	3 (2+1)
10		**Elective Course** (Non repeat one course from the list given below)	3 (2+ 1)
		Total grade Credit Hours:	**23 (13+10)**
***Non grade courses - 1. Human Values & Ethics :**			**1**
2. NSS / NCC / Rovers Rangers / Physical Education & Yoga :			**1**
Total Credit Hours in the semester = 22 + 2* = 25			

Table- 7 : Curriculum of :- 7th - Semester (4th –Year)

(Rural Entrepreneurship Awareness Development Yojana)

Rural Agricultural Work Experience & Agro-industrial Attachment (RAWE & AIA)

S. No.	Activities	Weeks	Credit Hours
1	General Orientation & On campus training by different faculties.	3	03
2	Village Attachment.	8	08
3	Unit Attachment in Univ./College/KVK/Research Stations /State Deptt. of Agriculture attachment.	3	03
4	Agri- clinic./ Plant nursery Care & Management	2	02
6	Agro-industrial/Local entrepreneur Attachment.	3	03
6	Project Report Preparation, Presentation & Self Evaluation.	1	01
	Total Weeks & Grade Credit Hours for RAWE & AIA:	**20**	**20**
	Total Marks:	**-**	**(100)**
		Total Credit Hours in the semester =	**20**

Table- 8 : Curriculum of :- 8th – Semester (4th –Year)

(Rural Entrepreneurship Awareness Development Yojana)

Skill Development And Entrepreneurship

(Experiential Learning Program / Hands On Training)

(A student has to register 20 credits hours by opting any two modules given below of (0+10) credits each (total 20 credits). Total maximum marks for each module shall be 50 and (total 2X50=100).

S. No.	Code	Title of module	Credit Hours
1		Production Technology for Bio-agents & Bio-fertilizer	0+10
2		Seed Production Technology	0+10
3		Mushroom Cultivation Technology	0+10
4		Soil, Plant, Water and Seed Testing	0+10
5		Commercial Beekeeping	0+10
6		Poultry Production Technology	0+10
7		Commercial Horticulture	0+10
8		Floriculture and Landscaping	0+10
9		Food Processing	0+10
10		Agriculture Waste Management	0+10
11		Commercial Sericulture	0+10
12		Watershed Management and Rain Water Harvesting	0+10
		Total Grade Credit Hours for ELP/HOT:	**0+20**
		Educational tour (Non grade Credit Hours*):	**2***
		Total Credit Hours in the semester	**22**

Table- 9 : (A) List of Elective Courses

(A student can select three electives courses out of the following offers during 4th , 5th and 7th semesters)

S. No.	Paper Code	Course/Papers Title	Credit Hours
1		Agribusiness Management	3 (2+1)
2		Agrochemicals	3 (2+1)
3		Commercial Plant Breeding	3 (2+1)
4		Food safety and Standards	3 (2+1)
5		Principles of Food Science & Human Nutrition	3 (2+1)
6		Protected Cultivation	3 (2+1)
7		Hi-tech Horticulture & Micro propagation Technology	3 (2+1)
8		Weed Management	3 (2+1)
9		System Simulation and Agro-advisory	3 (2+1)
10		Agricultural Journalism	3 (2+1)
11		Bio-pesticides & Bio-fertilizers	3 (2+1)
Total Credit Hours of Three Electives courses/Papers			**9(6+3)**

Table- 9 : (B) List of Non-grade courses

(I) The "*Human value & ethics*" is compulsory for all the students (for class room teaching & learning).

(II) The students may choose any one from "*NSS/NCC/Rovers Rangers/Physical Education & Yoga".*

Table- 10 : (A) Curriculum of Village Attachment (RAWE)

S. No.	Paper Code	Activities	Duration
1		Orientation & Village Survey	1 Week
2		Agronomical Interventions	1 Week
3		Plant Protection Interventions	1 Week
4		Soil Improvement Interventions (Soil sampling & Testing)	1 Week
5		Fruits & Vegetables Production Interventions	1 Week
6		Food / Dairy / Poultry Processing & Storage Interventions	1 Week
7		Animal Production Interventions	1 Week
8		Extension & Transfer Technology Activities	1 Week

Table- 10 : (B) Curriculum of Agro-Industrial/ Local entrepreneur Attachment

(Activities and Tasks)

- ***The students would be attached with the agro & cottage industries and commodities Boards for a period of 03 weeks to get an experience of the industrial environment and working. Industries include Seed/Sapling production, pesticides-Insecticides, Post harvest processing-Value addition, Agri-finance institution, Dairy &Poultry industries etc.***
- ***Acquainted with industry staff.***
- ***Study of structure, functioning, objective and mandates of the industry.***
- ***Study of various processing units and hands-on training under supervision of industry staff.***
- ***Ethics of industry.***
- ***Employment generation 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 students.***

3: Marks Distribution

Table- 11 : Mark Distribution of :- 1st - Semester (1st –Year)

S. No.	Paper Code	Course/Papers Title	Credit Hours	Mark Distribution			Total Marks
				M	P	T	
1		Fundamental of Plant Biochemistry & Physiology	3 (2+1)	20	30	50	100
2		Fundamental of Soil Science	3 (2+1)	20	30	50	100
3		Fundamental of Agronomy	3 (2+1)	20	30	50	100
4		Fundamental of Horticulture	2 (1+1)	20	30	50	100
5		Introduction of Forestry	2 (1+1)	20	30	50	100
6		Rural Sociology & Education Psychology	2 (2+0)	40	-	60	100
7		Agricultural Heritage	2 (2+0)	40	-	60	100
8		Comprehension & Communication English	1 (1+0)	40	-	60	100
9		Statistical Methods	2 (1+1)	20	30	50	100

Table- 12 : Mark Distribution of :- 2nd - Semester (1st –Year)

S. No.	Paper Code	Course/Papers Title	Credit Hours	Mark Distribution			Total Marks
				M	P	T	
1		Fundamental of Genetics	3 (2+1)	20	30	50	100
2		Agri-Informatics	2 (1+1)	20	30	50	100
3		Introductory Soil & Water Conservation	2 (1+1)	20	30	50	100
4		Fundamental of Bio-technology	2 (1+1)	20	30	50	100
5		Fundamental of Agricultural Economics	2 (2+0)	40	-	60	100
6		Fundamental of Plant Pathology	3 (2+1)	20	30	50	100
7		Fundamental of Entomology	3 (2+1)	20	30	50	100
8		Fundamental of Agricultural Extension Education	3 (2+1)	20	30	50	100
9		Communication Skills & Personality Development	2 (1+1)	20	30	50	100

Table- 13 : Mark Distribution of :- 3rd - Semester (2nd –Year)

S. No.	Paper Code	Course/Papers Title	Credit Hours	Mark Distribution			Total Marks
				M	P	T	
1		Crop Production Technology-I *(Kharif Crops)*	4 (1+3)	20	30	50	100
2		Fundamental of Plant Breeding	3 (2+1)	20	30	50	100
3		Agriculture Finance & Cooperation	3 (2+1)	20	30	50	100
4		Soil Microbiology	2 (1+1)	20	30	50	100
5		Farms Machinery & Power	2 (1+1)	20	30	50	100
6		Production Technology for Vegetable & Spices	2 (1+1)	20	30	50	100
7		Environmental Studies & Disaster Management	3 (2+1)	20	30	50	100
8		Livestock & Poultry Management	3 (2+1)	20	30	50	100
9		Renewable Energy & Green Technology	1 (1+0)	40	-	60	100

Table- 14 : Mark Distribution of :- 4th - Semester (2nd –Year)

S. No.	Paper Code	Course/Papers Title	Credit Hours	Mark Distribution			Total Marks
				M	P	T	
1		Crop Production Technology-II *(Rabi Crops)*	4 (1+3)	20	30	50	100
2		Production Technology for Ornamental Crops, MAP & Landscaping	2 (1+1)	20	30	50	100
3		Problematic Soils & their Management	2 (2+0)	40	-	60	100
4		Production Technology for Fruits & Plantation Crops	2 (1+1)	20	30	50	100
5		Principles of Seed Technology	3 (2+1)	20	30	50	100
6		Farming System & Sustainable Agriculture	1 (1+0)	40	-	60	100
7		Agricultural Marketing, Trade & Prices	3 (2+1)	20	30	50	100
8		Introductory Agro-meteorology & Climate Change	2 (1+1)	20	30	50	100
9		Dairy Science	3 (2+1)	20	30	50	100
10		**Elective Course** (any one course from the list given below)	3 (2+ 1)	20	30	50	100

Table- 15 : Mark Distribution of :- 5th - Semester (3rd –Year)

S. No.	Paper Code	Course/Papers Title	Credit Hours	Mark Distribution			Total Marks
				M	P	T	
1		Principles of Integrated Pest & Disease Management	3 (2+1)	20	30	50	100
2		Manures, Fertilizers & Soil Fertility Management	3 (2+1)	20	30	50	100
3		Pest of Crops and Stored grain & Their Management	3 (2+1)	20	30	50	100
4		Disease of Field and Horticultural Crops & Their Management-I	3 (2+1)	20	30	50	100
5		Crop Improvement-I *(Kharif Crops)*	2 (1+1)	20	30	50	100
6		Entrepreneurship Development & Business Communication	2 (1+1)	20	30	50	100
7		Geoinformatics and Nano-technology and Precision Farming	1 (1+0)	40	-	60	100
8		Intellectual Property Right	1 (1+0)	40	-	60	100
9		**Elective Course** (Non repeat one course from the list given below)	3 (2+ 1)	20	30	50	100

Table- 16 : Mark Distribution of :- 6th - Semester (3nd –Year)

S. No.	Paper Code	Course/Papers Title	Credit Hours	Mark Distribution			Total Marks
				M	P	T	
1		Rainfed Agriculture& Watershed Management	2 (1+1)	20	30	50	100
2		Protected Cultivation & Secondary Agriculture	2 (1+1)	20	30	50	100
3		Disease of Field & Horticulture Crops & Their Management-II	3 (2+1)	20	30	50	100
4		Post Harvest Management & Value Addition of Fruits & vegetables	2 (1+1)	20	30	50	100
5		Management of Beneficial Insects	2 (1+1)	20	30	50	100
6		Crop Improvement- II *(Rabi Crops)*	2 (1+1)	20	30	50	100
7		Principle of Organic Farming	2 (1+1)	20	30	50	100
8		Farm Management, Production & Resource Economics	2 (1+1)	20	30	50	100
9		Dairy Products Manufacturing Technology	3 (2+1)	20	30	50	100
10		**Elective Course** (Non repeat one course from the list given below)	3 (2+ 1)	20	30	50	100

Table- 17 Marks distribution for both :- 7th & 8th semester (4th Year)		
S. No.	**Evaluation Parameters for both semesters**	**Marks**
1	Project Planning & Writing	10%
2	Presentation	10%
3	Regularity	10%
4	Monthly Assessment	10%
5	Output Delivery	10%
6	Technical Skill Development	10%
7	Entrepreneurship Skill	10%
8	Business Networking Skills	10%
9	Report Writing Skills	10%
10	Final Presentation	10%
	Total Marks for:- 7th - Semesters-	**100**
	8th - Semesters-	**100**
	Minimum attendance requirement for both semesters-	**85%**

Note: There will be a committee for successful function & regulation of 7th & 8th semester. The committee will have following members-

1. Chairperson, (Principal of the College/Director of the Institution)

2. Program Coordinator, (A faculty teacher appointed by Principal/ Director of the Institution).

3. Program Officers, (At least one teacher from each subject of specialization)

This committee will be responsible for implementation & evaluation of the program according to the curriculum & performance of the students.

4: Syllabi (Major Courses)

Semester-I **Total Marks: 100 [** M:20+P:30+T:50 **]**

1. Fundamentals of Plant Biochemistry and Physiology 3 (2+1)

Theory

Unit-I: 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 Poly saccharides. 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. Metabolism of carbohydrates: Glycolysis, TCA cycle, Glyoxylate cycle, Electron transport chain. Metabolism of lipids: Beta oxidation, Biosynthesis of fatty acids.

Unit-II: Enzymes: General properties;Classification; Mechanism of action; Michaelis Menten and Line Weaver Burk equation & plots; Introduction to allosteric enzymes. Nucleic acids: Importance and classification; Structure of Nucleotides, A, B & Z DNA; RNA: Types and Secondary & Tertiary structure.

Unit-III: 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;

Unit-IV: Respiration: Glycolysis, TCA cycle and electron transport chain; Fat Metabolism: Fatty acid synthesis and Breakdown; Plant growth regulators: Physiological roles and agricultural uses, Physiological aspects of growth and development of major crops: Growth analysis, Role of Physiological growth parameters in crop productivity.

Practical

Preparation of solution, pH & buffers, Qualitative tests of carbohydrates and amino acids. Quantitative estimation of glucose/ proteins. Titration methods for estimation of amino acids/lipids, Effect of pH, temperature and substrate concentration on enzyme action, Paper chromatography/ TLC demonstration for separation of amino acids/ Monosaccharides. Study of plant cells, structure and distribution of stomata, imbibitions, osmosis, plasmolysis, measurement of root pressure, rate of transpiration, Separation of photosynthetic pigments through paper chromatography, Rate of transpiration, photosynthesis, respiration, tissue test for mineral nutrients, estimation of relative water content, Measurement of photosynthetic CO_2 assimilation by Infra Red Gas Analyser (IRGA).

Semester-I **Total Marks: 100 [**M:20+P:30+T:50**]**

2. Fundamentals of Soil Science 3 (2+1)

Theory

Unit-I: Soil as a natural body, Pedological and edaphological concepts of soil; Soil genesis: soil forming rocks and minerals; weathering, processes and factors of soil formation; Soil Profile, components of soil; Soil physical properties: soil-texture, structure, density and porosity, soil colour, consistence and plasticity; Elementary knowledge of soil taxonomy, classification and soils of India;

Unit-II: Soil water retention, movement and availability; Soil air, composition, gaseous exchange, problem and plant growth, Soil temperature; source, amount and flow of heat in soil; effect on plant growth, Soil reaction-pH, soil acidity and alkalinity, buffering, effect of pH on nutrient availability;

Unit-III: 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;

Unit-IV: soil organisms: macro and micro organisms, their beneficial and harmful effects; Soil pollution - behaviour of pesticides and inorganic contaminants, prevention and mitigation of soil pollution.

Practical

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

Semester-I **Total Marks: 100 [**M:20+P:30+T:50**]**

3. Fundamentals of Agronomy 3 (2+1)

Theory

Unit-I: Agronomy and its scope, seeds and sowing, tillage and tilth, crop density and geometry, Crop nutrition, manures and fertilizers, nutrient use efficiency,

Unit-II: water resources, soil-plant-water relationship, crop water requirement, water use efficiency, irrigation- scheduling criteria and methods, quality of irrigation water, logging.

Unit-III: Weeds- importance, classification, crop-weed competition, concepts of weed management principles and methods, herbicides- classification, selectivity and resistance, allelopathy.

Unit-IV: Growth and development of crops, factors affecting growth and development, plant ideotypes, croprotation and its principles, adaptation and distribution of crops, crop management technologies in problematic areas, harvesting and threshing of crops.

Practical

Identification of crops, seeds, fertilizers, pesticides and tillage implements, study of agroclimatic 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, herbicides and water requirement, Use of tillage implements-reversible plough, one way plough, harrow, leveler, seed drill, Study of soil moisture measuring devices, Measurement of field capacity, bulk density and infiltration rate, Measurement of irrigation water.

Semester-I **Total Marks: 100 [**M:20+P:30+T:50**]**

4. Fundamentals of Horticulture 2 (1+1)

Theory

Unit-I: Horticulture - Its definition and branches, importance and scope; horticultural and botanical classification; climate and soil for horticultural crops; Plant propagation-methods and propagating structures; Seed dormancy, Seed germination. Brief study of polyembryoney, parthenocarpy & incompatibility and Principles of orchard establishment.

Unit-II: Principles and methods of training and pruning, juvenility and flower bud differentiation; unfruitfulness; pollination, pollinizers and pollinators; fertilization and parthenocarpy; medicinal and aromatic plants; importance of plant bio-regulators in horticulture. Irrigation – methods, Fertilizer application in horticultural crops.

Practical

Identification of garden tools. Identification of horticultural crops. Preparation of seed bed/ nursery bed. Practice of sexual and asexual methods of propagation including micro-propagation. Layout and planting of orchard. Training and pruning of fruit trees. Preparation of potting mixture. Fertilizer application in different crops. Visits to commercial nurseries/orchard.

Semester-I **Total Marks: 100 [**M:20+P:30+T:50**]**

5. Introduction to Forestry 2 (1+1)

Theory

Unit-I: 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.

Unit-II: 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.

Semester-I **Total Marks: 100 [** M:40 + T:60 **]**

6. Rural Sociology & Educational Psychology 2 (2+0)

Theory

Unit-I: Sociology and Rural sociology: Definition and scope, its significance in agriculture extension, Rural Society: definition, characteristics. Community: definition, characteristics. Social Groups: definition, characteristics, classification, Self Help Group. Social Stratification: definitions function and type.

Unit-II: Culture : definition, characteristics, Intangible cultural heritage. Social Change & Development: definition, characteristics and factors in social change. Social Institutions-Panchayati Raj Institutions, cooperative society. Socio-economic survey of rural community including schedule and questionnaire.

Unit-III: Educational psychology: Meaning & its importance in agriculture extension. Behavior: Cognitive, affective, psychomotor domain, Learning, definition, type, learning curve, importance of learning in extension.

Unit-IV: Intelligence: definition, factor effecting intelligence, importance in extension. Personality: definition, elements, factors influencing growth and development. Motivation: definition, Theories of Motivation,

Semester-I **Total Marks: 100 [** M:40 + T:60 **]**

7. Agricultural Heritage 2 (2+0)

Theory

Unit-I: 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;

Unit-II: 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.

Semester-I **Total Marks: 100 [**M:20+P:30+T:50**]**

8. Comprehension and Communication Skills in English 2 (1+1)

Theory

Unit-I: War Minus Shooting- The sporting Spirit. A Dilemma- A layman looks at science Raymond B. Fosdick. You and Your English – Spoken English and broken English G.B. Shaw. Reading Comprehension, Vocabulary- Antonym, Synonym, Homophones, Homonyms, often confused words. Exercises to Help the students in the enrichment of vocabulary based on TOEFL and other competitive examinations.

Unit-II: Functional grammar: Articles, Prepositions, Verb, Subject verb Agreement, Transformation, Synthesis, Direct and Indirect Narration. Written Skills: Paragraph writing, Precise writing, Report writing and Proposal writing. The Style: Importance of professional writing. Preparation of Curriculum Vitae and Job applications. Synopsis Writing. Interviews: kinds, Importance and process.

Practical

Listening Comprehension: Listening to short talks lectures, speeches (scientific, commercial and general in nature). Oral Communication: Phonetics, stress and intonation, Conversation practice. Conversation: rate of speech, clarity of voice, speaking and Listening, politeness &Reading skills: reading dialogues, rapid reading, intensive reading, improving reading skills. Mock Interviews: testing initiative, team spirit, leadership, intellectual ability. Group Discussions.

Semester-I **Total Marks: 100 [**M:20+P:30+T:50**]**

9. Statistical Methods 2 (1+1)

Theory

Unit-I: 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.

Unit-II: 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.

Semester-II **Total Marks: 100 [**M:20+P:30+T:50**]**

1. Fundamentals of Genetics 3 (2+1)

Theory

Unit-I: Pre and Post Mendelian concepts of heredity, Mendelian principles of heredity. Architecture of chromosome; chromonemata, chromosome matrix, chromomeres, centromere, secondary constriction and telomere; special types of chromosomes. Chromosomal theory of inheritance- cell cycle and cell division- mitosis and meiosis.

Unit-II: Probability and Chi-square. Dominance relationships, Epistatic interactions with example. 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.

Unit-III: Structural and numerical variations in chromosome and their implications, Use of haploids, dihaploids and doubled haploids in Genetics. Mutation, classification, Methods of inducing mutations & CIB technique, mutagenic agents and induction of mutation.

Unit-IV: Qualitative & Quantitative traits, Polygenes and continuous variations, multiple factor hypothesis, 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. Mitosis and Meiosis cell division. 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 structures.

Semester-II **Total Marks: 100 [**M:20+P:30+T:50**]**

2. Agri-Informatics 2 (1+1)

Theory

Unit-I: 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.

Unit-II: 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.

Semester-II **Total Marks: 100 [**M:20+P:30+T:50**]**

3. Introductory Soil and Water Conservation Engineering 2 (1+1)

Theory

Unit-I: 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.

Unit-II: 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 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.

Semester-II **Total Marks: 100 [**M:20+P:30+T:50**]**

4. Fundamentals of Biotechnology 2 (1+1)

Theory

Unit-I: Concepts and applications of plant biotechnology: Scope, organ culture, embryo culture, cell suspension culture, callus culture, anther culture, pollen culture and ovule culture and their applications; Micro-propagation methods; organogenesis and embryogenesis, Synthetic seeds and their significance; Embryo rescue and its significance; somatic hybridization and cybrids; Somaclonal variation and its use in crop improvement; cryo-preservation;

Unit-II: Introduction to recombinant DNA methods: physical (Gene gun method), chemical (PEG mediated) and Agrobacterium mediated gene transfer methods; Transgenics and its importance in crop improvement; PCR techniques and its applications; RFLP, RAPD, SSR; Marker Assisted Breeding in crop improvement; Biotechnology regulations.

Practical

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

Semester-II **Total Marks: 100 [** M:40 + T:60 **]**

5. Fundamentals of Agricultural Economics 2 (2+0)

Theory

Unit-I: *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.

Unit-II: *Demand:* meaning, law of 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.

Unit-III: *Cost:* concepts, short run and long run cost curves. Supply: Stock v/s supply, law of supply, schedule, supply curve, determinants of supply, elasticity of supply. Market structure: meaning and types of market, basic features of perfectly competitive and imperfect markets. Price determination under perfect competition; short run and long run equilibrium of firm and industry, shut down and break even points. Distribution theory: meaning, factor market and pricing of factors of production. Concepts of rent, wage, interest and profit.

Unit-IV: *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 socioeconomic 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, supply, general price index, inflation and deflation. Banking: Role in modern economy, types of banks, functions of commercial and central bank, credit creation policy. Agricultural and public finance: meaning, micro v/s macro finance, need for agricultural finance, public revenue and public expenditure. *Tax:* meaning, direct and indirect taxes, agricultural taxation, VAT. *Economic systems:* Concepts of economy and its functions, important features of capitalistic, socialistic and mixed economies, elements of economic planning.

Semester-II **Total Marks: 100 [**M:20+P:30+T:50**]**

6. Fundamentals of Plant Pathology 3 (2+1)

Theory

Unit-I: *Introduction*: Importance of plant diseases, scope and objectives of Plant Pathology. History of Plant Pathology with special reference to Indian work. Terms and concepts in Plant Pathology. Pathogenesis. Causes / factors affecting disease development: disease triangle and tetrahedron and classification of plant diseases.

Unit-II: Important plant pathogenic organisms, different groups**:** fungi, bacteria, fastidious vesicular bacteria, phytoplasmas, spiroplasmas, viruses, viroids, algae, protozoa, phanerogamic parasites and nematodes with examples of diseases caused by them. Diseases and symptoms due to abiotic causes. *Fungi*: general characters, definition of fungus, somatic structures, types of fungal thalli, fungal tissues, modifications of thallus, reproduction (asexual and sexual). Nomenclature, Binomial system of nomenclature, rules of nomenclature, classification of fungi. Key to divisions, sub-divisions, orders and classes.

Unit-III: *Bacteria and mollicutes*: general morphological characters. Basic methods of classification and reproduction. *Viruses*: nature, general morphological charecters, replication and transmission. Study of phanerogamic plant parasites. *Nematodes:* General morphology and reproduction, classification, symptoms and nature of damage caused by plant nematodes (*Heterodera, Meloidogyne*, *Anguina, Radopholus* etc.) Growth and reproduction of plant pathogens.

Unit-IV: Liberation / dispersal and survival of plant pathogens. Types of parasitism and variability in plant pathogens. Pathogenesis. Role of enzymes, toxins and growth regulators in disease development. Defense mechanism in plants**.** Epidemiology: Factors affecting disease development. Principles and methods of plant disease management. Nature, chemical combination, classification, mode of action and formulations of fungicides and antibiotics.

Practical

Acquaintance with various laboratory equipments and microscopy. 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**.**

Semester-II **Total Marks: 100 [**M:20+P:30+T:50**]**

7. Fundamentals of Entomology 3 (2+1)

Theory

Unit – I

History of Entomology in India. Major points related to dominance of Insecta in Animal kingdom. Classification of phylum Arthropoda upto classes. Relationship of class Insecta with other classes of Arthropoda. Environment and its components. Effect of abiotic factors– temperature, humidity and rainfall, Effect of biotic factors – food competition and natural enemies on insects population and environmental resistance. Categories of pests.

Unit-II

Morphology: Structure and functions of insect cuticle and molting. Body segmentation. Structure of Head, thorax and abdomen. Structure and modifications of insect antennae, mouth parts, legs, Wing venation, modifications and wing coupling apparatus. Structure of male and female genital organ. Metamorphosis and diapause in insects. Types of larvae and pupae.

Unit-III

Anatomy- Structure and functions of digestive, circulatory, excretory, respiratory, nervous, secretary (Endocrine) and reproductive system, in insects. Types of reproduction in insects. Major sensory organs like simple and compound eyes.

Unit-IV

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

Practical

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

Semester-II **Total Marks: 100 [**M:20+P:30+T:50**]**

8. Fundamentals of Agricultural Extension Education 3 (2+1)

Theory

Unit-I: Education: Meaning, definition & Types; Extension Education- meaning, definition, scope process; objectives and principles; Extension efforts-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.).

Unit-II: Extension systems in India, Transfer of technology: concept and models, capacity building of extension personnel; New trends in agriculture extension: privatization extension, cyber extension/ e-extension, market-led extension, farmer-led extension, expert systems, etc. Extension teaching methods: meaning, classification, individual, group and mass contact methods, media mix strategies; communication: meaning and definition; models and barriers to communication.

Unit-III: Diffusion and adoption of innovation: concept and meaning, process and stages of adoption, adopter categories. Agriculture journalism. Rural Development: concept, meaning, definition; various rural development programmes launched by Govt. of India. Community Dev.-meaning, definition, concept & principles, Rural Leadership: concept and definition, types of leaders in rural context;

Unit-IV: Extension Programme planning- Meaning, Process, Principles and Steps in Programme Development. extension administration: meaning, concept, principles and functions. Monitoring and evaluation: concept and definition, monitoring and evaluation of extension programmes;

Practical

Preparation and use of AV aids including extension literature – leaflet, booklet, folder, pamphlet, news stories and success stories. Handling and use of audio visual equipments including digital camera and LCD projector.A visit to village to understand the problems being encountered by the villagers/ farmers. To understand PRA techniques and their application in village development planning. To visit to NGO and learning from their experience in rural development;

Semester-II **Total Marks: 100 [**M:20+P:30+T:50**]**

9. Communication Skills and Personality Development 2 (1+1)

Theory

Unit-I: Communication Skills: Structural and functional grammar; meaning and process of communication, verbal and nonverbal communication; Listening and note taking, writing skills, oral presentation skills; field diary and lab record; indexing, footnote and bibliographic procedures.

Unit-II: Reading and comprehension of general and technical articles, precise writing, summarizing, abstracting; individual and group presentations, impromptu presentation, Public speaking; Group discussion. Organizing seminars and conferences.

Practical

To practice about listening, note taking, writing skills, precise writing, summarizing, and abstracting.To prepare / know about field diary and lab record; indexing, footnote and bibliographic procedures. Reading and comprehension of general and technical articles. To know about Individual and group presentations. Presentation skills exercise. Group discussion- exercise;

Semester-III **Total Marks: 100 [**M:20+P:30+T:50**]**

1. Crop Production Technology-I *(Kharif Crops)* 4 (1+3)

Theory

Unit-I: Origin, geographical distribution, economic importance, soil and climatic requirements, varieties, cultural practices and yield of *Kharif* crops: Cereals – rice, maize, sorghum, pearl millet and finger millet, pulses-pigeonpea, mungbean and urdbean;

Unit-II: Origin, geographical distribution, economic importance, soil and climatic requirements, varieties, cultural practices and yield of *Kharif* crops: Oilseeds- groundnut, and soybean; fibre crops- cotton & jute; forage crops-sorghum, cowpea, cluster bean and napier.

Practical

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

Semester-III **Total Marks: 100 [**M:20+P:30+T:50**]**

2. Fundamentals of Plant Breeding 3 (2+1)

Theory

Unit-I: 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.

Unit-II: 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.

Unit-III: 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;

Unit-IV: 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.

Semester-III **Total Marks: 100 [**M:20+P:30+T:50**]**

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

Theory

UNIT-I: 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.

Unit-II: Sources of agricultural finance: institutional and non-institutional sources, commercial banks, social control and nationalization of commercial banks, Micro financing including KCC. Lead bank scheme, RRBs, Scale of finance and unit cost.

Unit-III: An introduction to higher financing institutions – RBI, NABARD, ADB, IMF, world bank, Insurance and Credit Guarantee Corporation of India. Cost of credit. Recent development in agricultural credit. Preparation and analysis of financial statements – Balance Sheet and Income Statement. Basic guidelines for preparation of project reports- Bank norms – SWOT analysis.

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

Practicals

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.

Semester-III **Total Marks: 100 [**M:20+P:30+T:50**]**

4. Soil Microbiology 2 (1+1)

Theory

Unit-I: Introduction. Microbial world: Prokaryotic and eukaryotic microbes. Bacteria: cell structure, chemoautotrophy, photo autotrophy, growth. Bacterial genetics: Genetic recombination transformation, conjugation and transduction, plasmids, transposon.

Unit-II: Role of microbes in soil fertility and crop production: Carbon, Nitrogen, Phosphorus and Sulphur cycles. Biological nitrogen fixation-symbiotic, associative and asymbiotic. Azolla, blue green algae and mycorrhiza. Rhizosphere and phyllosphere. Microbes in human welfare: silage production, biofertilizers, biopesticides, biofuel production and biodegradation of agro-waste.

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. Isolation of BGA. Staining and microscopic examination of microbes.

Semester-III **Total Marks: 100 [**M:20+P:30+T:50**]**

5. Farm Machinery and Power 2 (1+1)

Theory

Unit-I: Status of Farm Power in India, Sources of Farm Power , I.C. engines, working principles of I C engines, comparison of two stroke and four stroke cycle engines , Study of different components of I.C. engine, I.C. engine terminology and solved problems, Familiarization with different systems of I.C. engines: Air cleaning, cooling, lubrication ,fuel supply and hydraulic control system of a tractor, Familiarization with Power transmission system : clutch, gear box, differential and final drive of a tractor , Tractor types,

Unit-II: Cost analysis of tractor power and attached implement, Familiarization with Primary and Secondary Tillage implement, Implement for hill agriculture, implement for intercultural operations, Familiarization with sowing and planting equipment, calibration of a seed drill and solved examples, Familiarization with Plant Protection equipment, Familiarization with harvesting and threshing equipment.

Practicals

Study of different components of I.C. engine. To study air cleaning and cooling system of engine, Familiarization with clutch, transmission, differential and final drive of a tractor, Familiarization with lubrication and fuel supply system of engine, Familiarization with brake, steering, hydraulic control system of engine, Learning of tractor driving, Familiarization with operation of power tiller, Implements for hill agriculture, Familiarization with different types of primary and secondary tillage implements: mould plough, disc plough and disc harrow . Familiarization with 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.

Semester-III **Total Marks: 100 [**M:20+P:30+T:50**]**

6. Production Technology for Vegetable and Spices 2 (1+1)

Theory

Unit-I: 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, transplanting techniques, planting distance, fertilizer requirements, irrigation, weed management, harvesting and yield, physiological disorders, of important vegetable (Tomato, Cole crops such as Cabbage, Cauliflower, Knol-khol; Brinjal Capsicum, Cucumber, Melons, Gourds, Pumpkin, Peas; French bean, physiological disorders, of important vegetable and spices - Bulb crops such as Onion, Garlic; , Chilli, Root crops such as Carrot, Raddish, Beetroot; Tuber crops such as Potato; Leafy vegetables such as
Amaranth, Palak. Perennial vegetables).

Unit-II: Importance of spices in human nutrition and national economy. Brief about origin, area, climate, soil, improved varieties and cultivation practices such as time of sowing, transplanting techniques, planting distance, fertilizer requirements, irrigation, weed management, harvesting and yield of major spices- Cardamom, Black pepper, ginger, Fenugreek, Aniseed, Tree spices-Clove, Nutmeg, Cinnamon, and all other spices.

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.

Semester-III **Total Marks: 100 [**M:20+P:30+T:50**]**

7. Environmental Studies and Disaster Management 3 (2+1)

Theory

Unit-I: Definition, scope and importance of environment. Natural Resources: Renewable and non-renewable resources, Natural resources and associatedproblems**.(a) Forest resources:** Use and over-exploitation, deforestation, case studies. Timberextraction, mining, dams and their effects on forest and tribal people**. (b) Water resources:** Use andover-utilization of surface and ground water, floods, drought, conflicts over water, dams-benefitsand problems. **(c) Mineral resources**: Use and exploitation, environmental effects of extracting andusing mineral resources, case studies. **(d) Food resources**: World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizerpesticide problems, water logging, salinity, case studies**. (e) Energy resources**: Growing energy needs, renewable and nonrenewable energy sources, use of alternate energy sources.

Unit-II: 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. 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.

Unit-III: 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. 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.

Unit-IV: *Disaster Management:* Natural Disasters- Meaning and nature of natural disasters, their types and effects. Floods, drought, cyclone, earthquakes, landslides, avalanches, volcanic eruptions, Heat and co 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.

Semester-III **Total Marks: 100 [**M:20+P:30+T:50**]**

8. Livestock & Poultry Management 3 (2+1)

Theory:-

Unit-I: Role of livestock in the national economy including poultry. Livestock farming system in India. Important Indian and exotic breeds of cattle, buffalo, sheep, goat, swine and poultry. Housing principles, space requirements for different species of livestock. Business management skills with reference to livestock production.

Unit-II: Improvement of farm animals and poultry. Reproduction and their importance in farm animals and poultry. Management of calves, growing heifers and milch animals. Management of sheep, goat and swine. Management of poultry- Incubation, hatching, brooding, housing, growers and layers..

Unit-III: Digestion in livestock and poultry. Classification of feedstuffs- feed ingredients for ration for livestock and poultry. Basics of feed quality evaluation. Nutrients and their functions.. Feed supplements and feed additives. Principles of Feeding of livestock and poultry. Conservation of fodders.

Unit-IV: Meaning of heath & disease, Pathogenesis and immune system. Commonly used medical terms-antigens, antibiotics, antiseptics, disinfectant, and various terms used in description of infectious disease. Principles of spread & control of infectious disease. Common livestock & poultry diseases and their control measures-(Anthrax, Black quarter, Hemorrhagic, Septicemia, Mastitis, Foot & Mouth Disease, Milk fever, Brucellosis, worm infestation, Enterotoxaemia, metabolic disorders, Swine fever in pig, Poultry disease-Ranikhet, Marek's, Gambaro, Avian pox, Fowl cholera.)

Practical

External body parts of cattle, buffalo, sheep, goat, swine and poultry. Handling, restraining, 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.

Semester-III **Total Marks: 100 [** M:40 + T:60 **]**

9. Renewable Energy and Green Technology 1(1+0)

Theory

Unit-I: 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 bio-energy resource, introduction of solar energy, collection and their application,

Unit-II: 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.

Semester-IV **Total Marks: 100 [**M:20+P:30+T:50**]**

1. Crop Production Technology-II *(Rabi crops)* 4 (1+3)

Theory

Unit-I: Origin, geographical distribution, economic importance, soil and climatic requirements, varieties, cultural practices and yield of *Rabi* crops; cereals –wheat and barley, pulses-chickpea, lentil, peas, oilseeds-rapeseed, Rapeseed-mustard and sunflower;

Unit-II: Origin, geographical distribution, economic importance, soil and climatic requirements, varieties, cultural practices and yield of *Rabi* crops: sugar crops-sugarcane; medicinal and aromatic crops-mentha, lemon grass and citronella, 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. 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.

Semester-IV **Total Marks: 100 [**M:20+P:30+T:50**]**

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

Theory

Unit-I : 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. Indoor gardening, style of gardens, different fetuter of gardening and garden adornments.

Unit-II: Production technology of important medicinal plants like ashwagandha, asparagus, aloe, costus, Cinnamomum, periwinkle, isabgol and aromatic plants like mint, lemongrass, citronella, palmarosa, ocimum, rose, geranium, vetiver. Processing and value addition in ornamental crops and MAPs produce.

Practical

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

Semester-IV **Total Marks: 100 [** M:40 + T:60 **]**

3. Problematic Soils and their Management 2 (2+0)

Theory

Unit-I: Soil quality and health, Distribution of Waste land and problem soils in India. Their categorization based on properties.

Unit-II: Reclamation and management of Saline and sodic soils, Acid soils, Acid Sulphate soils, Eroded and Compacted soils, Flooded soils, Polluted soils.

Unit-III: Irrigation water – quality and standards, utilization of saline water in agriculture. Remote sensing and GIS in diagnosis and management of problem soils.

Unit-IV: Multipurpose tree species, bio remediation through MPTs of soils, land capability and classification, land suitability classification. Problematic soils under different Agro-ecosystems.

Semester-IV **Total Marks: 100 [**M:20+P:30+T:50**]**

4. Production Technology for Fruit and Plantation Crops 2 (1+1)

Theory

Unit-I: 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,

Unit-II: Production technologies for the cultivation of fruits: walnut, almond and; minor fruits- date, ber, pineapple, pomegranate, jackfruit, strawberry, plantation crops-coconut, areca nut, cashew, tea, coffee, cocoa, rubber, Palmyra & rubber.& 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.

Semester-IV **Total Marks: 100 [**M:20+P:30+T:50**]**

5. Principles of Seed Technology 3 (2+1)

Theory

Unit-I: 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.

Unit-II: 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.

Unit-III: 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.

Unit-IV: 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. Private and public sectors and their production and marketing strategies.

Practical

Seed production in major cereals: Wheat, Rice, Maize, Sorghum, Bajra and Ragi. Seed production in major pulses: Urd, Mung, Pigeonpea, Lentil, Gram, Field bean, pea. Seed production in major oilseeds: Soybean, Sunflower, Rapeseed, Groundnut and Mustard. Seed production in important vegetable crops. Seed sampling and testing: Physical purity, germination, viability, etc. Seed and seedling vigour test. Genetic purity test: Grow out test and electrophoresis. Seed certification: Procedure, Field inspection, Preparation of field inspection report. Visit to seed production farms, seed testing laboratories and seed processing plant.

Semester-IV **Total Marks: 100 [** M:40 + T:60 **]**

6. Farming System and Sustainable Agriculture 1 (1+0)

Theory

Unit-I: 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,

Unit-II: 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.

Semester-IV **Total Marks: 100 [**M:20+P:30+T:50**]**

7. Agricultural Marketing, Trade and Prices 3 (2+1)

Theory

Unit-I: 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;

Unit-II: 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);

Unit-III: 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;

Unit-IV: 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.

Semester-IV **Total Marks: 100 [**M:20+P:30+T:50**]**

8. Introductory Agro-meteorology & Climate Change 2 (1+1)

Theory

Unit-I: 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.

Unit-II: Monsoon- mechanism and importance in Indian agriculture,
Weather hazards - drought, floods, frost, tropical cyclones and extreme weather conditions such as heat-wave and cold-wave. Agriculture and weather relations; Modifications of crop microclimate, climatic normals for crop and livestock production. Weather forecasting- types of weather forecast and their uses. Climate change, climatic variability, global warming, causes of climate change and its impact on regional and national Agriculture.

Practical

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

Semester-IV **Total Marks: 100 [**M:20+P:30+T:50**]**

9. Dairy Science 3 (2+1)

Theory-

Unit-I: Secretion of milk. Colostrums its nature and properties. Composition of milk of different classes of animals. Details composition and properties of cow and buffalo milk. Factors affecting of quantities and quality of milk produced.

Unit-II: Nutritive value of milk. Milk and public health, clean milk production, Microorganism of milk and their functions, Basic principles of cleaning and sanitization of dairy equipment. Common adulterants and preservatives used in milk and their detection methods.

Unit-III: Milk Processing – Milk collection, Agencies engaged in handling and transporting of milk. Pricing of milk**.** The standardization, Cream separation- principles, methods and their factors affecting.

Unit-IV: Various method of milk preservation- Pasteurization, Homogenization, Sterilization and other alternative methods. Milk filtration- Clarification, Bactofugation and Membrane Processing of milk and its importance. Principles of milk packaging & storage.

Practical:-

Sampling method of milk for laboratory analysis. Analysis of milk for- total solids, solids not fat, milk fat, ash, specific gravity and acidity. Quality assessment of milk by various plate form test. Assessment of milk for microbiological quality. Dairy arithmetic calculations.

Semester-V **Total Marks: 100 [**M:20+P:30+T:50**]**

1. Principles of Integrated Pest Management 3 (2+1)

Theory

Unit-I: Categories of insect pests, IPM: Introduction, history, importance, concepts, principles and tools, Limitation of IPM.

Unit-II: Economic importance of insect pests, pest risk analysis. Methods of detection and diagnosis of insect pest. Calculation and dynamics of economic injury level and importance of Economic threshold level.

Unit-III: Tools of IPM or Methods of control: Host plant resistance, cultural, mechanical, physical, legislative, biological and chemical control and bio technological control. Recent methods of pest control, repellents, antifeedants, hormones, attractants, gamma radiation. Ecological management of crop environment. Introduction to conventional pesticides for the insect pests management.
Unit-IV: Survey surveillance and forecasting of Insect pest. Development and validation of IPM module. Implementation and impact of IPM. 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 insect pests, , Methods of insect pests measurement, Assessment of crop yield losses, calculations based on economics of IPM, Identification of biocontrol agents, different predators and natural enemies. Mass multiplication of Bt, NPV and *Beauvaria bassiana* etc. Identification and nature of damage of important insect pests and their management. Crop (agroecosystem) dynamics of a selected insect pest. Plan & assess preventive strategies (IPM module) and decision making. crop monitoring attacked by insect pest. Awareness campaign at farmers fields. Insecticides and their formulations. Pesticide appliances and their maintenance. Sampling techniques for estimation of insect population and damage.

Semester-V **Total Marks: 100 [**M:20+P:30+T:50**]**

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

Theory

Unit-I: 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.

Unit-II: 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.

Unit-III: 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.

Unit-IV: 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.

Semester-V **Total Marks: 100 [**M:20+P:30+T:50**]**

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

Theory

Unit-I: General account on nature and type of damage by different arthropods pests. Scientific name, order, family, host range, distribution, bionomics, nature of damage and management of major pests of major field crops.

Unit-II: Scientific name, order, family, host range, distribution, bionomics, nature of damage, and management of major pests of major vegetable crops.

Unit-III: Scientific name, order, family, host range, distribution, bionomics, nature of damage, and management of major pests of major Fruit crops.

Unit-IV: Factors affecting losses of stored grain and role of physical, biological, mechanical and chemical factors in deterioration of grain. Insect pests, mites, rodents 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. Identification of insect pests and Mites associated with stored grain. Assessment of losses due to insects. Calculations on the doses of insecticides application technique. Identification of rodents and rodent control operations in godowns.. Methods of grain sampling under storage condition. Visit to nearest FCI/ storage godowns.

Semester-V **Total Marks: 100 [**M:20+P:30+T:50**]**

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

Theory

Unit-I: 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;

Unit-II: Symptoms, etiology, disease cycle and management of major diseases of following crops: 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.

Unit-III: : Symptoms, etiology, disease cycle and management of major diseases of following crops: 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; Coconut: wilt and bud rot; Tea: blister blight; Coffee: rust

Unit-IV: Symptoms, etiology, disease cycle and management of major diseases of following crops: Cruciferous vegetables: Alternaria leaf spot and black rot; Brinjal: Phomopsis blight and fruit rot and Sclerotinia blight; Tomato: damping off, bacterial 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;

Practical

Identification and histopathological studies of selected diseases of field and horticultural crops covered in theory. Field visit for the diagnosis of field problems. Collection and preservation of plant diseased specimens for Herbarium; Note: Students should submit 50 pressed and well mounted specimens.

Semester-V **Total Marks: 100 [**M:20+P:30+T:50**]**

5. Crop Improvement – I (*Kharif*) 2 (1+1)

Theory

Unit-I: 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, study of genetics of qualitative and quantitative characters;

Unit-II: 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); Hybrid seed production technology in Maize, Rice, Sorghum, Pearl millet and Pigeonpea, etc. Ideotype concept and climate resilient crop varieties for future.

Practical

Floral biology, emasculation and hybridization techniques in different crop species; viz., Rice, Jute, Maize, Sorghum, Pearl millet, Ragi, Pigeonpea, Urdbean, Mungbean, Soybean, Groundnut, Seasame, Caster, Cotton, Cowpea, Tobacco, Brinjal, Okra and Cucurbitaceous crops. 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.

Semester-V **Total Marks: 100 [**M:20+P:30+T:50**]**

6. Entrepreneurship Development and Business Communication 2 (1+1)

Theory

Unit-I: Concept of Entrepreneur, Entrepreneurship Development, Characteristics of entrepreneurs; Assessment of entrepreneurship skills, SWOT Analysis & achievement motivation, Entrepreneurial behavior. Government policy and programs and institutions for entrepreneurship development, Entrepreneurial Development Process;

UNIT-II: Business Leadership Skills; Communication skills for entrepreneurship development, Developing organizational skill , Developing Managerial skills, Problem solving skill, Time management; Supply chain management and Total quality management, Project Planning Formulation and report preparation; Opportunities for entrepreneurship and rural entrepreneurship.

Practical

To assessing entrepreneurial potential, problem solving ability and managerial skills. To study about achievement motivation with examples.To exercise in creativity and time audit. Preparation of business plan and proposal writing. Visit to entrepreneurship development institute and entrepreneurs.

Semester-V **Total Marks: 100 [** M:40 + T:60 **]**

7. Geo-informatics, Nano-technology and Precision Farming 1 (1+0)

Theory

Unit-I: 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;

Unit-II: Remote sensing concepts and application in agriculture; Image processing and interpretation; Global positioning system (GPS), components and its functions; 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 seed, water, fertilizer, plant protection for scaling-up farm productivity.

Semester-V **Total Marks: 100 [** M:40 + T:60 **]**

8. Intellectual Property Rights 1 (1+0)

Theory

Unit-I: Introduction and meaning of intellectual property, brief introduction to GATT, WTO, TRIPs and WIPO, Treaties for IPR protection: Madrid protocol, Berne Convention, Budapest treaty, etc. Types of Intellectual Property and legislations covering IPR in India:-Patents, Copyrights, Trademark, Industrial design, Geographical indications, Integrated circuits, Trade secrets. Patents Act 1970 and Patent system in India, patentability, process and product patent, filing of patent, patent specification, patent claims, Patent opposition and revocation, infringement, Compulsory licensing, Patent Cooperation Treaty, Patent search and patent database.

Unit-II: Origin and history including a brief introduction to UPOV for protection of plant varieties, Protection of plant varieties under UPOV and PPV&FR Act of India, Plant breeders rights, Registration of plant varieties under PPV&FR Act 2001, breeders, researcher and farmers rights. Traditional knowledge-meaning and rights of TK holders. Convention on Biological Diversity, International treaty on plant genetic resources for food and agriculture (ITPGRFA). Indian Biological Diversity Act, 2002 and its salient features, access and benefit sharing.

Semester-VI **Total Marks: 100 [**M:20+P:30+T:50**]**

1. Rainfed Agriculture and Watershed Management 2 (1+1)

Theory

Unit-I: 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;

Unit-II: 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**.**

Semester-VI **Total Marks: 100 [**M:20+P:30+T:50**]**

2. Protected Cultivation and Secondary Agriculture 2 (1+1)

Theory

Unit-I: 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.

Unit-II: 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.

Semester-VI **Total Marks: 100 [**M:20+P:30+T:50**]**

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

Theory

Unit-I: Symptoms, etiology, disease cycle and management of following diseases of Field Crops: Wheat: rusts, loose smut, karnal bunt, powdery mildew, alternaria blight, and ear cockle; Sugarcane: red rot, smut, wilt, grassy shoot, ratoon stunting and Pokkah Boeng;

Unit-II: Symptoms, etiology, disease cycle and management of following diseases of Sunflower: Sclerotinia stem rot and Alternaria blight; Mustard: Alternaria blight, white rust, downy mildew and Sclerotinia stem rot; Gram: wilt, grey mould and Ascochyta blight; Lentil: rust and wilt; Cotton: anthracnose, vascular wilt, and black arm; Pea: downy mildew, powdery mildew and rust.

Unit-III: Symptoms, etiology, disease cycle and management of following diseases of Horticultural Crops: Mango: anthracnose, malformation, bacterial blight and powdery mildew; Citrus: canker and gummosis; Citrus greening; Grape vine: downy mildew, Powdery mildew and anthracnose; Apple: scab, powdery mildew, fire blight and crown gall; Peach: leaf curl.
Strawberry: leaf spot

Unit-IV: Symptoms, etiology, disease cycle and management of following diseases: Potato: early and late blight, black scurf, common 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; Turmeric: leaf spot, Coriander: stem gall, Marigold: Botrytis blight; Rose: dieback, powdery mildew and black leaf spot.

Practical

Identification and histopathological studies of selected diseases of field and horticultural crops covered in theory. Field visit for the diagnosis of field problems. Collection and preservation of plant diseased specimens for herbarium. Students should submit 50 pressed and well-mounted specimens.

Semester-VI **Total Marks: 100 [**M:20+P:30+T:50**]**

4. Post-harvest Management and Value Addition of Fruits and Vegetables 2 (1+1)

Theory

Unit-I: 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). Technique of prolonging the life of fruits & vegetables. Handling and packing of fruits & vegitables.

Unit-II: 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.

Semester-VI **Total Marks: 100 [**M:20+P:30+T:50**]**

5. Management of Beneficial Insects 2 (1+1)

Theory

Unit-I: Importance of beneficial Insects, Beekeeping and pollinators, bee biology, commercial methods of rearing, equipment used, seasonal management. Bee pasturage, bee foraging and communication. Insect pests and diseases of honey bee. Role of pollinators in cross pollinated plants. Types of silkworm, voltinism and biology of silkworm. Mulberry cultivation, mulberry varieties and methods of harvesting and preservation of leaves. Rearing, mounting and harvesting of cocoons. Pest and diseases of silkworm, management, rearing appliances of mulberry silkworm and methods of disinfection.

Unit-II: Species of lac insect, morphology, biology, host plant, lac production – seed lac, button lac, shellac, lac- products. Identification of major parasitoids and predators commonly being used in biological control. 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. Types of silkworm, voltinism and biology of silkworm. Mulberry cultivation, mulberry varieties and methods of harvesting and preservation of leaves. Species of lac insect, host plant identification. Identification of other important pollinators, weed killers and scavengers. Visit to research and training institutions devoted to beekeeping, sericulture, lac culture and natural enemies. Identification and techniques for mass multiplication of natural enemies.

Semester-VI **Total Marks: 100 [**M:20+P:30+T:50**]**

6. Crop Improvement – II (*Rabi Crops*) 2 (1+1)

Theory

Unit-I: Centers of origin, distribution of species, wild relatives in different cereals; pulses; oilseeds; fodder crops and cash crops; vegetable and horticultural crops; Plant genetic resources, its utilization and conservation; study of genetics of qualitative and quantitative characters;

Unit-II: 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); Hybrid seed production technology of *rabi* crops. Ideotype concept and climate resilient crop varieties for future.

Practical

Floral biology, emasculation and hybridization techniques in different crop species namely Wheat, Oat, Barley, Chickpea, Lentil, Field pea, Rajma, Horse gram, Rapeseed Mustard, Sunflower, Safflower, Potato, Berseem. Sugarcane, Tomato, Chilli, Onion; Handling of germplasm and segregating populations by different methods like pedigree, bulk and single seed decent methods; Study of field techniques for seed production and hybrid seeds production in *Rabi* crops; Estimation of heterosis, inbreeding depression and heritability; Layout of field experiments; Study of quality characters, study of donor parents for different characters; Visit to seed production plots; Visit to AICRP plots of different field crops

Semester-VI **Total Marks: 100 [**M:20+P:30+T:50**]**

7. Principles of Organic Farming 2 (1+1)

Theory

Unit-I: 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;

Unit-II: 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.

Semester-VI **Total Marks: 100 [**M:20+P:30+T:50**]**

8. Farm Management, Production and Resource Economics 2(1+1)

Theory

Unit-I: 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 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.

Unit-: 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.

Semester-VI **Total Marks: 100 [**M:20+P:30+T:50**]**

9. Dairy Products Manufacturing Technology 3 (2+1)

Theory

Unit-I :- Methods of manufacturing of Market milk and different kind of specialize milk such as- Sterilized milk, Homogenized milk, Flavored milk, standardized milk, Reconstituted milk, Recombined milk, Toned & Double milk, Fermented milk- Cultured butter milk, Acidophilus milk, Yoghurt.

Unit-II:- Methods of manufacturing of Indigenous milk products- Panner, Chhana, Ghee, Khoa, Dahi & Misti dahi Shrikhand.

Unit-III:- Methods of manufacturing of (a) fat rich milk products- Cream, Butter and Butter oil. (b) Frozen milk product- Ice-cream & Kulfi (c) Fermented product-Cheese, Processed cheese.

Unit-IV :- Methods of manufacturing of Concentrated milk products- Condensed & Evaporated milk, Dry milk products- Whole milk powder, Skim milk powder & Baby foods, Milk by products- Casein, whey proteins & Lactose.

Practical

Preparation of Standardized milk, Flavored milk, Reconstituted & Recombined milk, Acidophilus milk, Yoghurt, Toned & Doubled milk. Preparation of Khoa, Ghee, Dahi, and Ice-cream. Dairy arithmetic related to milk product preparation. Assessment of quality & cost of production of milk products.
Visit of a milk Processing Plant.

4: Syllabi (Elective courses)

(Elective) **Total Marks: 100 [**M:20+P:30+T:50**]**

1. Agri-business Management 3 (2+1)

Theory

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

Unit-II:- Institutional arrangement, procedures to set up agro based industries. Constraints in establishing agro-based industries. Agri-value chain: Understanding primary and support activities and their linkages. Business environment: PEST & SWOT analysis.

Unit-III:-Management functions: Roles & activities, Organization culture. Planning, meaning, definition, types of plans. Purpose or mission, goals or objectives, Strategies, polices procedures, rules, programs and budget. Components of a business plan, Steps in planning and implementation. Organization staffing, directing and motivation. Ordering, leading, supervision, communications, control.

Unit-IV: Capital Management and Financial management of Agribusiness. Financial statements and their importance. Marketing Management: Segmentation, targeting & positioning. Marketing mix and marketing strategies. Consumer behaviour analysis, Product Life Cycle (PLC). Sales & Distribution Management. Pricing policy, various pricing methods. Project Management definition, project cycle, identification, formulation, appraisal, implementation, monitoring and evaluation. Project Appraisal and evaluation techniques.

Practical

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

(Elective) **Total Marks: 100 [**M:20+P:30+T:50**]**

2. Agrochemicals 3 (2+1)

Theory

Unit-I:- 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.

Unit-II:- 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.

Uni-III:- 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.

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

Practical

Sampling of fertilizers and pesticides. Pesticides application technology to study about various pesticides appliances. Quick tests for identification of common fertilizers. Identification of anion and cation in fertilizer. Calculation of doses of insecticides to be used. To study and identify various formulations of insecticide available kin market. Estimation of nitrogen in Urea. Estimation of water soluble P_2O_5 and citrate soluble P_2O_5 in single super phosphate. Estimation of potassium in Muraite of Potash/ Sulphate of Potash by flame photometer. Determination of copper content in copper oxychloride. Determination of sulphur content in sulphur fungicide. Determination of thiram. Determination of ziram content.

(Elective) **Total Marks: 100 [**M:20+P:30+T:50**]**

3. Commercial Plant Breeding 3 (2+1)

Theory

Unit-I:- 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.

Unit-II:- 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.

Unit-III:- Alternative strategies for the development of the line and cultivars: haploid inducer, tissue culture techniques and biotechnological tools.

Unit-IV:- 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.

(Elective) **Total Marks: 100 [**M:20+P:30+T:50**]**

4. Food Safety and Standards 3 (2+1)

Theory

Unit-I:- Food Safety – Definition, Importance, Scope and Factors affecting Food Safety. Hazards and Risks, Types of hazards - Biological, Chemical, Physical hazards. Management of hazards - Need. Control of parameters. Temperature control. Food storage. Product design.

Unit-II:- Hygiene and Sanitation in Food Service Establishments- Introduction. Sources of contamination and their control. Waste Disposal. Pest and Rodent Control. Personnel Hygiene.

Unit-III:-Food Safety Measures. Food Safety Management Tools- Basic concepts. PRPs, GHPs, GMPs, SSOPs etc. HACCP. ISO series. TQM - concept and need for quality, components of TQM, Kaizen. Risk Analysis. Accreditation and Auditing, Water Analysis, Surface Sanitation and Personal Hygiene.

Unit-IV:- Food laws and Standards- Indian Food Regulatory Regime, FSSA. Global Scenario CAC. Other laws and standards related to food. Recent concerns- New and Emerging Pathogens. Packaging, Product labeling and Nutritional labeling. Genetically modified foods\ transgenics. Organic foods. Newer approaches to food safety. Recent Outbreaks. Indian and International Standards for food products.

Practical

Water quality analysis physico-chemical and microbiological. Preparation of different types of media. Microbiological Examination of different food samples. Assessment of surface sanitation by swab/rinse method. Assessment of personal hygiene. Biochemical tests for identification of bacteria. Scheme for the detection of food borne pathogens. Preparation of plans for Implementation of FSMS - HACCP, ISO: 2200.

(Elective) **Total Marks: 100 [**M:20+P:30+T:50**]**

5. Principles of Food Science and Human Nutrition 3 (2+1)

Theory

Unit-I: Concepts of Food Science (definitions, measurements, density, phase change, pH, osmosis, surface tension, colloidal systems etc.); Malnutrition (over and under nutrition), nutritional disorders; Energy metabolism (carbohydrate, fat, proteins); Balanced/ modified diets, Menu planning, New trends in food science and nutrition.

Unit-II: Food composition and chemistry (water, carbohydrates, proteins, fats, vitamins, minerals, flavours, colours, miscellaneous bioactives, important reactions);

Unit-II: Food microbiology (bacteria, yeast, moulds, spoilage of fresh & processed foods, Production of fermented foods);

Unit-IV: Principles and methods of food processing and preservation (use of heat, low temperature, chemicals, radiation, drying etc.).

(Elective) **Total Marks: 100 [**M:20+P:30+T:50**]**

6. Protected Cultivation 3 (2+1)

Theory

Unit-I: Protected cultivation- importance and scope, Status of protected cultivation in India and World types of protected structure based on site and climate.

Unit-II: 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.

Unit-III: 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.

Unit-IV: 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.

(Elective) **Total Marks: 100 [**M:20+P:30+T:50**]**

7. Hi-tech. Horticulture & Micro propagation Technologies 3 (2+1)

Unit-I: Introduction & importance; Nursery management and mechanization; micro propagation of horticultural crops; Modern field preparation and planting methods. Equipments and chemical required for tissue culture. Steps taken in tissue culture for the production of plants.

Unit-II: Protected cultivation: advantages, controlled conditions, method and techniques, Micro irrigation systems and its components; EC, pH based fertilizer scheduling, canopy management, high density orcharding,

Unit-III: 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. Introduction, History, Advantages and limitations;

Unit-IV: Types of cultures (seed, embryo, organ, callus, cell), Stages of micropropagation, Auxiliary 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. 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.

(Elective) **Total Marks: 100 [**M:20+P:30+T:50**]**

8. Weed Management 3 (2+1)

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.

(Elective) **Total Marks: 100 [**M:20+P:30+T:50**]**

9. System Simulation and Agro-advisory 3 (2+1)

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.

(Elective) **Total Marks: 100 [**M:20+P:30+T:50**]**

10. Agricultural Journalism 3 (2+1)

Theory

Unit-I:- Agricultural Journalism: The nature and scope of agricultural journalism characteristics and training of the agricultural journalist, how agricultural journalism is similar to and different from other types of journalism.

Unit-II:- Newspapers and magazines as communication media: Characteristics;
kinds and functions of newspapers and magazines, characteristics of newspaper and magazine readers. Form and content of newspapers and magazines: Style and language of newspapers and magazines, parts of newspapers and magazines.

Unit-III:- The agricultural story: Types of agricultural stories,
subject matter of the agricultural story, structure of the agricultural story. Gathering agricultural information: Sources of agricultural information, interviews, coverage of events, abstracting from research and scientific materials, wire services, other agricultural news sources.

Unit-IV:- Writing the story:
Organizing the material, treatment of the story, writing the news lead and the body, readability measures. Illustrating agricultural stories: Use of photographs, use of artwork (graphs, charts, maps, etc.), writing the captions. Editorial mechanics: Copy reading, headline and title writing, proofreading, lay outing.

Practical
Practice in interviewing. Covering agricultural events. Abstracting stories from research and scientific materials and from wire services. Writing different types of agricultural stories. Selecting pictures and artwork for the agricultural story. Practice in editing, copy reading, headline and title writing, proofreading, layouting. Testing copy with a readability formula. Visit to a publishing office.

(Elective) **Total Marks: 100 [**M:20+P:30+T:50**]**

11. Bio-pesticides & Bio-fertilizers 3 (2+1)

Theory

Unit-I:- History and concept of biopesticides. Importance, scope and potential of biopesticide. Definitions, concepts and classification of biopesticides viz. pathogen, botanical pesticides, and Bio-rationales.

Unit-II:- Mass production technology of bio-pesticides. Virulence, pathogenicity and symptoms of entomo-pathogenic 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.

Unit-III:- 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- mycorrhiza and ectomycorhiza. Nitrogen fixation -Free living and symbiotic nitrogen fixation. Mechanism of phosphate solubilization and phosphate mobilization, K solubilization.

Unit-IV:- Production technology: Strain selection, sterilization, growth and fermentation, mass production of carrier based and liquid biofertiizers. FCO specifications and quality control of biofertilizers. Application technology for seeds, seedlings, tubers, sets etc. Biofertilizers -Storage, shelf life, quality control and marketing. Factors influencing the efficacy of biofertilizers.

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.

6: Syllabi (Non-grade Courses)

Non-grade courses [(2 credit Hours/ Semester) Total: 2 X 6= 12]

Note:- (1) The human value & ethics is compulsory for all the students (for class room teaching & learning = 01 credit hours/semester).

(2) The students may choose any one from:-

(A) NSS (B) NCC (C) Rovers & Rangers (D) Physical education & yoga

1. Human Value and Ethics

(Taught by among faculty members) (1 Credit Hours/ Semester)

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. The entire courses should be offered continuously for three years and having one credit load per semester.

2. (A) National Service Scheme

(Taught by N.S.S. Program Officer/s) (1 Credit Hours/ Semester)

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. All the activities related to the National Service Scheme course is . The entire courses should be offered continuously for two years. A student enrolled in NSS course should put in at least 60 hours of social work in different activities in a semester other than five regular one day camp in a year and one special camp for duration of 7 days at any semester break period in the two year. Different activities will include orientation lectures and practical works.Activities directed by the Central and State Government have to be performed by all the volunteers of NSS as per direction.

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

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

Understanding youth

Definition, 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 peacebuilding

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.

Importance and role of youth leadership

Meaning, types and traits of leadership, qualities of good leaders; importance and roles of youth leadership

Life competencies

Definition and importance of life competencies, problem-solving and decision-making, inter personal communication

Youth development programmes

Development of youth programmes and policy at the national level, state level and voluntary sector; youth-focused and youth-led organisations

Health, hygiene and sanitation

Definition needs and scope of health education; role of food, nutrition, safe drinking water, water born diseases and sanitation (Swachh Bharat Abhiyan) for health; national health programmes and reproductive health.

Youth health, lifestyle, HIV AIDS and first aid

Healthy lifestyles, HIV AIDS, drugs and substance abuse, home nursing and first aid

Youth and yoga

History, philosophy, concept, myths and misconceptions about yoga; yoga traditions and its impacts, yoga as a tool for healthy lifestyle, preventive and curative method

Vocational skill development

To enhance the employment potential and to set up small business enterprises skills of volunteers, a list of 12 to 15 vocational skills will be drawn up based on the local conditions and opportunities. Each volunteer will have the option to select two skill-areas out of this list

Issues related environment

Environmental conservation, enrichment and sustainability, climatic change, natural resource management (rain water harvesting, energy conservation, forestation, waste land development and soil conservations) and waste management

Disaster management

Introduction and classification of disaster, rehabilitation and management after disaster; role of NSS volunteers in disaster management.

Entrepreneurship development

Definition, meaning and quality of entrepreneur; steps in opening of an enterprise and role of financial and support service institution.

Formulation of production oriented project

Planning, implementation, management and impact assessment of project

Documentation and data reporting

Collection and analysis of data, documentation and dissemination of project reports

Youth and crime

Sociological and psychological factors influencing youth crime, cyber crime, pear mentoring in preventing crime and awareness for juvenile justice

Civil/self defence

Civil defence services, aims and objectives of civil defence; needs and training of self defence

Resource mobilisation

Writing a project proposal of self fund units (SFUs) and its establishment

Additional life skills

Positive thinking, self confidence and esteem, setting life goals and working to achieve them, management of stress including time management.

Activities directed by the Central and State Government

(B). National Cadet Corps (NCC)

(Taught by N.C.C. Officer/s) **(1 Credit Hours/ Semester)**

1. Aims, objectives, organization of NCC and NCC song. DG's cardinals of discipline.
2. Drill- aim, general words of command, attention, stands at ease, stand easy and turning.
3. Sizing, numbering, forming in three ranks, open and close order march and dressing.
4. Saluting at the halt, getting on parade, dismissing and falling out.
5. Marching, length of pace, and time of marching in quick/slow time and halt. Side pace, pace forward and to the rear.
6. Turning on the march and wheeling. Saluting on the march.
7. Marking time, forward march and halt.
8. Changing step, formation of squad and squad drill.
9. Command and control, organization, badges of rank, honours and awards
10. Nation Building- cultural heritage, religions, traditions and customs of India. National integration.
11. Values and ethics, perception, communication, motivation, decision making, discipline and duties of good citizen.
12. Leadership traits, types of leadership. Character/personality development.
13. Civil defense organization, types of emergencies, fire fighting, protection,
14. Maintenance of essential services, disaster management, aid during development projects.
15. Basics of social service, weaker sections of society and their needs, NGO's and their contribution, contribution of youth towards social welfare and family planning.
16. Structure and function of human body, diet and exercise, hygiene and sanitation.
17. Preventable diseases including AIDS, safe blood donation, first aid, physical and mental health.
18. Adventure activities
19. Basic principles of ecology, environmental conservation, pollution and its control.
20. Precaution and general behaviour of girl cadets, prevention of untoward incidents, vulnerable parts of the body, self defense.
21. Arms Drill- Attention, stand at ease, stand easy. Getting on parade. Dismissing and falling out. Ground/take up arms, examine arms.
2. Shoulder from the order and vice-versa, present from the order and vice-versa.
23. Saluting at the shoulder at the halt and on the march. Short/long trail from the order and viceversa.
24. Guard mounting, guard of honour, Platoon/Coy Drill.
25. Characteristics of rifle (.22/.303/SLR), ammunition, fire power, stripping, assembling, care, cleaning and sight setting.
26. Loading, cocking and unloading. The lying position and holding.
27. Trigger control and firing a shot. Range Procedure and safety precautions. Aiming and alteration of sight.
28. Theory of groups and snap shooting. Firing at moving targets. Miniature range firing.
29. Characteristics of Carbine and LMG.
30. Introduction to map, scales and conventional signs. Topographical forms and technical terms.

31. The grid system. Relief, contours and gradients. Cardinal points and finding north. Types of bearings and use of service protractor.
32. Prismatic compass and its use. Setting a map, finding north and own position. Map to ground and ground to map.
33. Knots and lashings, Camouflage and concealment, Explosives and IEDs.
44. Field defenses obstacles, mines and mine lying. Bridging, waterman ship
35. Field water supplies, tracks and their construction.
36. Nuclear, Chemical and Biological Warfare (NCBW)
37. Judging distance. Description of ground and indication of landmarks.
38. Recognition and description of target. Observation and concealment. Field signals. Section formations.
39. Fire control orders. Fire and movement. Movement with/without arms. Section battle drill.
40. Types of communication, media, latest trends and developments.

(C). Rovers & Rangers

(Taught by Program Officer in-charge) **(1 Credit Hours/ Semester)**

1.Brief history of scouting in the world and in India.Defnition,aims & objectives, methods and goals & scope of scouting. Scouting for boys and rangers girls guiding in India, WAGGGS. Scoute / guide promise, Rovers/Rangers motto, scout sign and hand shake.
2. Knowledge of organizational structure of scouting/guiding. Knowledge of scout/guide uniform, dress code and different flags.
3. Know about and do practices-knot & lashing of pratham sopan & their uses- (i) Reef knot (ii) sheet band (iii) sheep shank (iv) Bowline (v) clove hitch (vi) Eisher man's knot.
4. One round turn & two half hitches and Whipping.
5. Other necessary curriculum as per requirement.

(D). Physical Education and Yoga Practices

(Taught by Physical Education Officer) **(1 Credit Hours/ Semester)**

1. Teaching of skills of Football – demonstration, practice of the skills, correction, involvement in game situation (For girls teaching of Tennikoit)
2. Teaching of skills of Basketball – demonstration, practice of the skills, correction of skills, involvement in game situation
3. Teaching of skills of Kabaddi – demonstration, practice of the skills, correction of skills, involvement in game situation, rules of the game
4. Teaching of advance skills of Kabaddi – involvement of all the skills in game situation with teaching of rule of the game
5. Teaching of skills of Ball Badminton – demonstration, practice of the skills, correction of skills, involvement in game situation
6. Teaching of skills of Table Tennis – demonstration, practice of skills, correction and practice and involvement in game situation, rules of game
7. Teaching – Meaning, Scope and importance of Physical Education, Definition, Type of Tournaments. Physical Fitness and Health Education
8. Construction and laying out of the track and field (*The girls will have Tennikoit and Throw Ball).
9. Teaching of skills of Hockey – demonstration practice of the skills and correction. And involvement of skills in games situation

1o. Teaching of advance skills of Kho-Kho – demonstration practice of the skills and correction. Involvement of all the skills in games situation with teaching of rules of the game
11. Teaching of different field track events – demonstration practice of the skills and correction with competition among them.
12. Teaching of different asanas – demonstration practice and correction.
13. Teaching of weight training – demonstration practice and correction.
14. Teaching of circuit training – demonstration practice and correction.
15. Teaching of calisthenics – demonstration practice and correction.
Note: (1) Compulsory Uniform: Half pants, Tee Shirts, Shoes and socks all white (Girls will have white Tee Shirt and Track pants) **(2)** The games mentioned in the practical may be inter changed depending on the season and facilities.

7: Appendix

Appendix-1 : Design of Mark Sheet of 1st ,2nd ,3rd 4th, 5th & 6th semester

Papers code & title	***Credit Hours assigned to the paper***	***Point Scored=*** (Marks obtained x Credit Hours) 10
1.---------- **2.----------** **3.----------** **4.----------** **.** **.** **.** Back Papers: 1. 2.	**-----** **-----** **-----** **-----**	**-------** **-------** **-------** **-------**
Total Credit =	**------**	**Total Point Scored = ----------**

Grade Point Average(GPA) of the Semester = Total Point Scored/Total Credit Hours = ----------

Result = Pass / Fail

Final Result (Summary)

Grade Point Average (GPA) of the 1st Semester = ……..
Grade Point Average (GPA) of the 2nd Semester = ……
Grade Point Average (GPA) of the 3rd Semester = ……
Grade Point Average (GPA) of the 4th Semester = ……
Grade Point Average (GPA) of the 5th Semester = ……
Grade Point Average (GPA) of the 6th Semester = ……
Grade Point Average (GPA) of the 7th Semester = ……
Grade Point Average (GPA) of the 8th Semester = ……

Overall Grade Point Average(OGPA) = …… Result = Pass/Fail
Overall Percentage = ……. Division = ……

Appendix-2 : Design of Mark Sheet of 7th semester

Papers code & title	***Credit Hours assigned to the paper***	***Point Scored=*** (Marks obtained x Credit Hours) 10
(Rural Entrepreneurship Awareness Development Yojana) *Rural Agricultural Work Experience & Agro-industrial Attachment (RAWE & AIA)* 1. General Orientation & On campus training 2. Village Attachment. 3. Unit Attachment in Univ./College/KVK/Research Stations/State Deptt. of Agriculture attachment. 4. Agri- clinic./ Plant nursery Care & Management 5. Agro-industrial/ Local entrepreneur Attachment. 6. Project Report Preparation, Presentation & Self Evaluation Back Papers: 1. 2.	***3*** ***8*** ***3*** ***2*** ***3*** ***1***	***** ***** ***** ***** ***** *****
Total Credit =	------	**Total Point Scored =** ----------
Grade Point Average(GPA) of the Semester = Total Point Scored/Total Credit Hours = ----------		
Result = Pass / Fail		

Final Result (Summary)

Grade Point Average (GPA) of the 1st Semester = ……..
Grade Point Average (GPA) of the 2nd Semester = ……
Grade Point Average (GPA) of the 3rd Semester = ……
Grade Point Average (GPA) of the 4th Semester = ……
Grade Point Average (GPA) of the 5th Semester = ……
Grade Point Average (GPA) of the 6th Semester = ……
Grade Point Average (GPA) of the 7th Semester = ……
Grade Point Average (GPA) of the 8th Semester = ……

Overall Grade Point Average (OGPA) = …… Result = Pass/Fail
Overall Percentage = ……. Division = ……

Appendix-3 : Design of Mark Sheet of 8th semester

Papers code & title	***Credit Hours assigned to the paper***	***Point Scored=*** (Marks obtained x Credit Hours) 10
(Rural Entrepreneurship Awareness Development Yojana) Skill Development And Entrepreneurship (Experiential Learning Program / Hands On Training) 1. ..... 2. ..... Back Papers: 1. 2.	***10*** ***10***	***** *****
Total Credit =	**------**	**Total Point Scored = ----------**

Grade Point Average(GPA) of the Semester = Total Point Scored/Total Credit Hours = ----------

Result = Pass / Fail

Final Result (Summary)

Grade Point Average (GPA) of the 1st Semester = ……..
Grade Point Average (GPA) of the 2nd Semester = ……
Grade Point Average (GPA) of the 3rd Semester = ……
Grade Point Average (GPA) of the 4th Semester = ……
Grade Point Average (GPA) of the 5th Semester = ……
Grade Point Average (GPA) of the 6th Semester = ……
Grade Point Average (GPA) of the 7th Semester = ……
Grade Point Average (GPA) of the 8th Semester = ……

Overall Grade Point Average(OGPA) = …… Result = Pass/Fail
Overall Percentage = ……. Division = ……