

**SYLLABUS AND COURSE BREAKUP
FOR
BACHELOR OF SCIENCE
(AGRICULTURE)**

**Approved by the Academic Council
(Resolution No. 7183, dated 7.11.2016 and 7372, dated 17.7.2018)**

**ODISHA UNIVERSITY OF AGRICULTURE AND TECHNOLOGY
BHUBANESWAR – 751003**

COLLEGE OF AGRICULTURE, BHUBANESWAR
SYLLABUS AND COURSE BREAKUP

Ist Semester, 1st Year B.Sc. (Hons.) Agriculture

Sl. No.	Course No.	Course title	Credit hours
01	Hort-111	Fundamentals of Horticulture	2(1+1)
02	AS-111	Statistical Methods	2(1+1)
03	AC-111	Fundamentals of Soil Science	3(2+1)
04	Fo(Ag)-111	Introduction to Forestry	2(1+1)
05	SE-111	Comprehension & Communication Skills in English	2(1+1)
06	AG-111	Fundamentals of Agronomy	4(3+1)
07	AE-111	Fundamentals of Agricultural Economics	2(2+0)
08	EE-111	Rural Sociology and Educational Psychology	2(2+0)
09	AG-112	Agriculture Heritage*	1(1+0)*
10	BB-111/ BM-111	Introductory Biology*/ Elementary Mathematics*	2(1+1)*/ 2(2+0)*
11	EE-112	Human Values & Ethics (Non gradial)**	1(1+0)**
12	NSS-111/ NCC-111/ PE-111	NSS**/ NCC**/ Physical Education & Yoga Practices**	2 (0+2)**
		Total	19+04*/03*+ 03**
*R: Remedial course; **NC: Non-gradial courses			

IInd Semester, 1st Year B.Sc.(Hons.) Agriculture

Sl. No,	Course No.	Course Title	Credit hours
01	PBG-121	Fundamentals of Genetics	3(2+1)
02	AC-122	Agricultural Microbiology	2(1+1)
03	SWE(Ag)- 121	Soil and Water Conservation Engineering	2(1+1)
04	PP-121	Fundamentals of Crop Physiology and Application	3(2+1)
05	AG-123	Crop geography and ecology	2(2+0)
06	PPT-121	Fundamentals of Plant Pathology	3(2+1)
07	ENT-121	Fundamentals of Entomology	4(3+1)
08	EE-123	Fundamentals of Agricultural Extension Education	3(2+1)
09	EE-124	Communication Skills and Personality Development	2(1+1)
		Total	24(16+8)

IIIrd Semester, 2nd Year B.Sc.(Hons.) Agriculture

Sl. No.	Course No	Course Title	Credit Hours
01	AG-214	Crop Production Technology-I (Kharif Crops)	2(1+1)
02	PBG-212	Fundamental of Plant Breeding	3(2+1)
03	AE-212	Agricultural Finance and Cooperation	3(2+1)
04	AM-211	Introductory Agro-meteorology&Climate Change	2(1+1)
05	FMP(Ag)211	Farm Machinery & Power	2(1+1)
06	HORT-212	Production Technology for Vegetable & Spices	2(1+1)
07	AC-213	Environmental Studies and Disaster Management	3(2+1)
08	ABT-211	Fundamentals of Plant Biochemistry & Biotechnology	3(2+1)
09	LPM(AW)-211	Livestock & Poultry Management	4(3+1)
	TOTAL		24(15+9)

IVth Semester, 2nd Yr. B.Sc. (Hons.) Agriculture

Sl. No.	Course No	Course Title	Credit hours
01	AG-225	Crop Production Technology-II (Rabi Crops)	2(1+1)
02	Hort-223	Production Technology for Ornamental Crops, MAP and Landscaping	2(1+1)
03	FMP(Ag)-222	Renewable Energy and Green Technology	2(1+1)
04	AC-224	Problematic Soils and their Management	2(1+1)
05	HORT-224	Production Technology for fruits and Plantation crops	2(1+1)
06	SST-221	Principles of Seed Science & Technology	2(1+1)
07	AG-226	Farming System & Sustainable Agriculture	1(1+0)
08	AE-223	Agricultural Marketing Trade & Prices	3(2+1)
09	AM-222	Agriculture Informatics	3(1+2)
10	NEM-221	Introductory Nematology	2(1+1)
		Total	21(11+10)
	Elective course (Any one): AC(E)-221/ AG(E)-221/ HORT(E)-221/ PBG(E)-221		
11	AC(E)-221	Agrochemicals	3(2+1)
12	AG(E)-221	Water Management and micro irrigation	3(2+1)
13	HORT(E)-221	Landscaping	3(2+1)
14	PBG(E)-221	Commercial Plant Breeding	3(1+2)

Vth Semester, 3rd Year B.Sc. (Hons.) Agriculture

Sl. No.	Course No.	Title	Credit hours
01	PPT-312	Principle of Integrated Pest and Disease Management	3(2+1)
02	AC-315	Manures, Fertilizers and Soil Fertility Management	3(2+1)
03	ENT-312	Pests of Crops and Stored Grain and their Management	3(2+1)
04	PPT-313	Disease of field and Horticultural Crops and their Management-1	3(2+1)
05	PBG-313	Crop Improvement-I (Kharif Crops)	2(1+1)
06	AE-314	Farm Management, Production & Resource Economics	2(1+1)
07	SST-312	Seed Quality Testing	1(0+1)
08	AG-317	Geoinformatics and Nanono-technology for Precision Farming	2(1+1)
09	CP-311	Practical Crop Production-I (Kharif Crops)	2(0+2)
10	PBG-314	Intellectual Property Rights	1(1+0)
Elective Course (any one)			22(12+10)
11	HORT(E)-313	Hi-Tech Horticulture	3(2+1)- FSHT/SWCE
12	AC(E)-312	Bio-pesticides & bio-fertilizers	3(2+1)-SSAC/ Ent/Pl.Path
13	AG(E)-312	Weed Management	3(2+1)-
14	ABT(E)-311	Micropropagation Technologies	3(1+2)- ABT

VIth Semester, 3rd Year B.Sc.(Hons.) Agriculture

Sl. No.	Course code	Title	Credit hours
01	AG-328	Rainfed Agriculture & Watershed Management	2(1+1)
02	ASCE(Ag)321	Protected Cultivation and Secondary Agriculture	2(1+1)
03	PPT-324	Disease of Field and Horticultural Crops and their Management-II	3(2+1)
04	HORT-325	Post-Harvest Management and Value Addition Horticultural Crops	2(1+1)
05	ENT-323	Management of Beneficial Insects	2(1+1)
06	PBG-325	Crop Improvement-II (Rabi Crops)	2(1+1)
07	CP-322	Practical Crop Production-II (Rabi Crops)	2(0+2)
08	AG-329	Principles of Organic Farming	2(1+1)
09	EE-325	Entrepreneurship Development and Business Communication	2(1+1)
10	FSN(Ag)-321	Principles of Food Science and Nutrition	2(2+0)
Elective (any one)			
11	HORT(E)-323	Protected cultivation	3(2+1)
12	AC(E)-323	Soil ,Plant, Water & Seed Testing	3(1+2)
13	AG(E)-323	Agricultural Waste Management	3(2+1)

14	AE(E)-321	Agri-business Management	3(2+1)
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VIIth Semester, 4th Year B.Sc.(Hons.) Agriculture

Sl. No.	Course code	Title	Credit hours
01	Village Attachment/ Unit Attachment in Univ./ College KVK/ Res.Stn.	RAWE-411	0+14
02	Agro-Industrial Attachment	RAWE-412	0+6
	TOTAL		20(0+20)

VIIIth Semester, 4th Year B.Sc.(Hons.) Agriculture

Sl. No.	Course code	Title	Credit hours
01	Experiential learning programme	ELP-421	0+10
02	Experiential learning programme	ELP-422	0+10
	TOTAL		20(0+20)

SYLLABUS AND COURSE BREAKUP

Ist Semester, 1st Year B.Sc. (Hons.) Agriculture

01. HORTICULTURE

- a. Course No : Hort-111
- b. Course title : Fundamentals of Horticulture
- c. Credit hour : 2(1+1)
- d. Class : 1st year B.Sc. (Hons.) Agril.
- e. Semester : 1st Semester

SYLLABUS

Theory

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

Practical

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

02. STATISTICS, COMPUTER APPLICATION & IPR

- a. Course No : AS-111
- b. Course title : Statistical Methods
- c. Credit hour : 2(1+1)
- d. Class : 1st year B.Sc. (Hons.) Agril.
- e. Semester : 1st Semester

SYLLABUS

Theory

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

of Attributes in 2 × 2 Contingency Table. Introduction to Analysis of Variance, Analysis of One Way Classification. Introduction to Sampling Methods, Sampling versus Complete Enumeration, Simple Random Sampling with and without replacement, Use of Random Number Tables for selection of Simple Random Sample.

Practical

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

03. SOIL SCIENCE & AGRICULTURAL CHEMISTRY

- a. Course No : AC-111
- b. Course title : Fundamentals of Soil Science
- c. Credit hour : 3(2+1)
- d. Class : 1st year B.Sc. (Hons.) Agril.
- e. Semester : 1st Semester

SYLLABUS

Theory

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

04. FORESTRY

- a. Course No : Fo.(Ag)-111
- b. Course title : Introduction to Forestry
- c. Credit hour : 2(1+1)
- d. Class : 1st year B.Sc. (Hons.) Agril.
- e. Semester : 1st Semester

Objective: To provide knowledge about fundamental aspects of forestry including forest role, classification, regeneration, tending operations, measurement of important tree parameters, agroforestry systems, identification of tree species, forest nursery raising and cultivation of important fast growing tree species.

Theory

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

Practical

Identification of tree-species. Diameter and girth 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, alternate and hypsometer. Volume measurement of logs using various formulae. Nursery lay out, seed sowing, vegetative propagation techniques. visit of nearby Forest plantations and forests. Visits of nearby forest based industries.

05. LANGUAGE

- a. Course No : SE-111
- b. Course title : Comprehension and Communication Skills in English
- c. Credit hour : 2(1+1)
- d. Class : 1st year B.Sc. (Hons.) Agril.
- e. Semester : 1st Semester

SYLLABUS

Theory

War Minus Shooting- The sporting Spirit. A Dilemma- A layman looks at science Raymond B. Fosdick. You and Your English – Spoken English and broken English G.B. Shaw. Reading Comprehension, Vocabulary- Antonym, Synonym, Homophones, Homonyms, often confused words. Exercises to Help the students in the enrichment of vocabulary based on TOEFL and other competitive examinations. Functional grammar: Articles, Prepositions, Verb, Subject verb Agreement, Transformation, Synthesis, Direct and Indirect Narration. Written Skills: Paragraph writing, Precise writing, Report writing and Proposal writing. The Style: Importance of professional writing. Preparation of Curriculum Vitae and Job applications. Synopsis Writing. Interviews: kinds, Importance and process.

Practical

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

06. AGRONOMY:

- | | |
|-----------------|---|
| a. Course No | : AG-111 |
| b. Course title | : Fundamentals of Agronomy |
| c. Credit hour | : 4(3+1) |
| d. Class | : 1 st year B.Sc. (Hons.) Agril. |
| e. Semester | : 1 st Semester |

SYLLABUS

Theory

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

Weeds- importance, classification, crop weed competition, concepts of weed management-principles and methods, herbicides- classification, selectivity and resistance, allelopathy. Growth and development of crops, factors affecting growth and development, plant ideotypes, crop rotation and its principles, adaptation and distribution of crops, crop management technologies in problematic areas, harvesting and threshing of crops.

Practical

Identification of crops, seeds, fertilizers, pesticides and tillage implements, Effect of sowing depth on germination and seedling vigour, 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.

07. AGRICULTURAL ECONOMICS

- a. Course No : AE-111
- b. Course title : Fundamentals of Agricultural Economics
- c. Credit hour : 2(2+0)
- d. Class : 1st year B.Sc. (Hons.) Agril.
- e. Semester : 1st Semester

Theory:

Economics: Meaning, scope and subject matter, definitions, activities, approaches to economic analysis; micro and macro economics, positive and normative analysis. Nature of economic theory; rationality assumption, concept of equilibrium, economic laws as generalization of human behavior. Basic concepts: Goods and services, desire, want, demand, utility, cost and price, wealth, capital, income and welfare.

Agricultural economics: meaning, definition, characteristics of agriculture, importance and its role in economic development. Agricultural planning and development in the country.

Demand: meaning, law of demand, demand schedule and demand curve, determinants, utility theory; law of diminishing marginal utility, equi-marginal utility principle. Consumer's equilibrium and derivation of demand curve, concept of consumer surplus. Elasticity of demand: concept and measurement of price elasticity, income elasticity and cross elasticity.

Production: process, creation of utility, factors of production, input output relationship. Laws of returns: Law of variable proportions and law of returns to scale. *Cost:* Cost concepts, short run and long run cost curves. *Supply:* Stock v/s supply, law of supply, supply schedule, supply curve, determinants of supply, elasticity of supply.

Market structure: meaning and types of market, basic features of perfectly competitive and imperfect markets. Price determination under perfect competition; short run and long run equilibrium of firm and industry, shut down and break even points.

Distribution theory: meaning, factor market and pricing of factors of production. Concepts of rent, wage, interest and profit.

National income: Meaning and importance, circular flow, concepts of national income accounting and approaches to measurement, difficulties in measurement. Good and services tax (GST) - meaning, definition, advantage and disadvantages and its implication on Indian Economy.

Tax: meaning, direct and indirect taxes, agricultural taxation.

08. EXTENSION EDUCATION

- a. Course No : EE-111
- b. Course title : Rural Sociology & Educational Psychology
- c. Credit hour : 2(2+0)
- d. Class : 1st year B.Sc. (Hons.) Agril.
- e. Semester : 1st Semester

SYLLABUS

Theory

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

importance in agriculture extension. Behavior: Cognitive, affective, psychomotor domain, Personality, Learning, Motivation, Theories of Motivation, Intelligence.

REMEDIAL COURSES

09. AGRONOMY

- a. Course No : AG-112
- b. Course title : Agriculture Heritage
- c. Credit hour : 1(1+0)
- d. Class : 1st year B.Sc. (Hons.) Agril.
- e. Semester : 1st Semester

SYLLABUS

Theory

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

10. BIOLOGY

- a. Course No : BB-111
- b. Course title : Introductory Biology
- c. Credit hour : 2(1+1)
- d. Class : 1st year B.Sc. (Hons.) Agril.
- e. Semester : 1st Semester

SYLLABUS

Theory

Introduction to the living world, diversity and characteristics of life, origin of life, Evolution and Eugenics. Binomial nomenclature and classification Cell and cell division. Morphology of flowering plants. Seed and seed germination. Plant systematic- viz; Brassicaceae, Fabaceae and Poaceae. Role of animals in agriculture.

Practical

Morphology of flowering plants – root, stem and leaf and their modifications. Inflorescence, flower and fruits. Cell, tissues & cell division. Internal structure of root, stem and leaf. Study of specimens and slides. Description of plants - Brassicaceae, Fabaceae and Poaceae.

11. MATHEMATICS

- a. Course No : BM-111
- b. Course title : Elementary Mathematics
- c. Credit hour : 2(2+0)
- d. Class : 1st year B.Sc. (Hons.) Agril.
- e. Semester : 1st Semester
- f. General objective :
- g. Specific objective :

SYLLABUS

Theory

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

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

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

NON-GRADIAL COURSES

12. EXTENSION EDUCATION

- a. Course No : EE-112
- b. Course title : Human values and Ethics
- c. Credit hour : 1(1+0)
- d. Class : 1st year B.Sc. (Hons.) Agril.
- e. Semester : 1st Semester
- f. General objective :
- g. Specific objective :

SYLLABUS

Theory

Universal human aspirations: Happiness and prosperity; Human values and ethics: Concept, definition, significance and sources; Fundamental values: Right conduct, peace, truth, love and non-violence; Ethics: professional, environmental, ICT; Sensitization towards others particularly senior citizens, developmentally challenged and gender. Spirituality, positive attitude and scientific temper; Team work and volunteering; Rights and responsibilities; Road safety; Human relations and family harmony; Modern challenges and value conflict: Sensitization against drug abuse and other social evils; Developing personal code of conduct (SWOT Analysis); Management of anger and stress.

(A) Theory lecture outline

Lecture No.	Topic
01	Introduction values and ethics- Need and Basic guidelines
02	Goal and mission of life-How to the goal and mission of life, differentiate between right and wrong
03	Vision of life- Social harmony, understanding harmony in the nature and existence
04	Principles of leading a happy life Philosophy of happy life
05	Self Exploration-meaning, content and process
06 & 07	Self Awareness and self satisfaction-
08	Decision Making-meaning and process
09	Motivation-concept, meaning and definition. Achievement motivation with ethical values
10	Sensitivity-meaning and definitions. Application to emotional feelings in life
11	Case studies of ethical lives
12	Positive spirit-positive attitude can lead to a better life
13	Body, Mind and Soul-the interrelationship between three
14	Attachment and detachment- in intimate relationship
15	Spirituality Quotient-IQ, EQ and SQ. The difference among three. SQ essentially sets human being apart.
16	Examination

13. NSS/NCC/Physical Education & Yoga Practices

- a. Course No :
- b. Course title : NSS/NCC/Physical Education & Yoga Practices

- c. Credit hour : 2(0+2)
 d. Class : 1st year B.Sc. (Hons.) Agril.
 e. Semester : 1st Semester

SYLLABUS

Theory

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

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

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

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

- a. Course No : NSS-111
 b. Course title : National Service Scheme
 c. Credit hour : 2(0+2)
 d. Class : 1st year B.Sc. (Hons.) Agril.

e. Semester : 1st Semester

SYLLABUS

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, analyzing guiding financial patterns of scheme, youth programme/schemes of GOI, coordination with different agencies and maintenance of diary

Understanding youth

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

Community mobilization

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

Social harmony and national integration

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

Volunteerism and shramdan

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

Citizenship, constitution and human rights

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

Family and society

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

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|-----------------|---|
| a. Course No | : PE 111 |
| b. Course title | : Physical Education |
| c. Credit hour | : 2(0+2) |
| d. Class | : 1 st year B.Sc. (Hons.) Agril. |
| e. Semester | : 1 st Semester |

SYLLABUS

Practical

NSS: Orientation of students in national problems, study of philosophy of NSS, fundamentals rights, directive principles of state policy, socio-economic structure of Indian society, population problems, brief of five year plan. Functional literacy, nonformal education or rural youth, eradication of social evils, awareness programmes, consumer awareness, highlights of consumer act. Environment enrichment and conservation, health, family welfare and nutrition. NCC: introduction to NCC, defence services, system of NCC training, foot drill, sizing, forming up in three ranks, open and close order march, dressing, gettingon parade, dismissing and falling out, saluting, marching, arms drill, shoulder arm, order arm, present arm, guard of honour. ceremonial drill, weapon training-rifle, bayonet, light machine gun, sten machine carbine. Introduction and characteristic stripping,

assembling and cleaning, loading, unloading and firing. Field craft, visual training, targets, judging distance, fire discipline and fire control orders, battle craft, field signals, description of ground, section formation, section battle drill, scouts and patrols, ambush, field engineering map reading, conventional science, grid systems, use of service protectors, prismatic compass and its use, self defence, general principle, precaution and training, attacks and counter attacks, marching and searching, first aid, hygiene and sanitation, civil defence, leadership NCC song. Physical Education: Introduction to physical education. Posture, exercise for good posture, physical fitness exercises for agility, strength, coordination, endurance and speed. Rules and regulations of important game, skill development in any one of the games, football, hockey, cricket, volleyball, badminton, through ball, tennis. Participation in one of the indoor game, badminton, chess and table tennis. Rules and regulations of athletic events, participation in any one of the athletic events, long jump, high jump, triple jump, javelin, discus through, shot put, short and long distance running, safety education, movement education, effective way of doing day –to- day activities. First –aid training, coaching for major games and indoor games. Asanas and indigenous ways for physical fitness and curative exercises. Exercises and games for leisure time, use and experience.

Note: Warming up and conditioning exercises and compulsory before the commencement of each class.

SYLLABUS AND COURSE BREAKUP

IInd Semester, 1st Year B.Sc.(Hons.) Agriculture

01. PLANT BREEDING AND GENETICS

f. Course No	: PBG-121
g. Course title	: Fundamentals of Genetics
h. Credit hour	: 3(2+1)
i. Class	: 1 st year B.Sc. (Hons.) Agril.
j. Semester	: 2 nd Semester

SYLLABUS

Theory

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

Practical

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

02. SOIL SCIENCE & AGRICULTURAL CHEMISTRY

a. Course No	: AC-122
b. Course title	: Agricultural Microbiology
c. Credit hour	: 2(1+1)
d. Class	: 1 st year B.Sc. (Hons.) Agril.
e. Semester	: 2 nd Semester

SYLLABUS

Theory

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

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

Practical

Introduction to microbiology laboratory and its equipments; Microscope- parts, principles of microscopy, resolving power and numerical aperture. Enumeration of microbial population in soil- bacteria, fungi, actinomycetes. Methods of isolation and purification of microbial cultures. Isolation of *Rhizobium* from legume root nodule. Isolation of *Azotobacter* from soil. Isolation of *Azospirillum* from roots. Staining and microscopic examination of microbes. Experiments on O.M. decomposition & evolution of CO₂ in soil, Experiments on Urea hydrolysis, Morphological study of nitrogen fixing nodules, Study of BGA & observation of heterocyst, Methods of application of Biofertilizers in the field.

COURSE BREAKUP

(A) Theory lecture outline

Lecture No.	Topic
01	Introduction to microbiology, Brief History of microbiology, microbial world: prokaryotic and eukaryotic microbes.
02	Bacteria: Cell structure, chemoautotrophy, photo autotrophy, growth.
03	Bacterial genetics: Concept of Genetic recombination-transformation, conjugation and transduction; Plasmids, transposon.
04	Rhizosphere and Phyllosphere microflora, factors affecting growth of microbes in soil.
05	Role of microbes on soil fertility & crop production: C-cycle- Importance, sources of organic materials in soil, their composition and degradability, changes during decomposition of organic materials in soil
06	Key groups of organisms involved in aerobic and anaerobic decomposition, Significance of C:N ratio of added organic materials in soil, Humus – Definition, composition and properties.
07	N-cycle: Biological nitrogen fixation- mechanism in symbiotic, associative and asymbiotic N ₂ fixers.
08	Mineralization and immobilization of N, ammonification, nitrification and denitrification in soil
09	Revision
10	Phosphorus cycle: Microbial transformation of P in soil, Mineralization, immobilization, solubilization, oxidation-reduction of different forms of P in soil.
11	Mycorrhiza: Definition, classification and functions.
12	S-Cycle: Mineralization, immobilization, oxidation- reduction of different forms of S in soil.
13	Microbes in human welfare: Biofertilizers- Definition, classification, methods of application, advantages and limitations in use.
14	Bio-pesticides – Definition, classification and methods of application.
15	Silage making, Biofuel production
16	Biodegradation: Definition of biodegradation, composition of biogas, microbiology of biogas production and use of biogas as manures.

(B) Practical class outline

Class No.	Exercise
01	Acquaintance with microbiology laboratory & its equipments.
02	Microscope: Parts, principles of microscopy, resolving power and numerical aperture.
03	Methods of sterilization. Nutritional media and their preparations.
04	Enumeration of microbial population (bacteria, fungi, actinomycetes) in soil by serial dilution technique
05	Staining and microscopic examination of microbes (Gram staining)
06	Determination of organic matter decomposition in soil through CO ₂ evolution (Alkali trap method)
07	Estimation of urea hydrolysis in solution
08	Study of Ammonification/ Nitrification in Solution
09	Study of Denitrification in Solution
10	Morphological study of nitrogen fixing legume nodules
11	Study of BGA and observation of Heterocyst/Methods of application of biofertilizers in the field

Reference books:

- Soil Microbiology – N. S. Subba Rao, Oxford & IBH publishing Co. Pvt. Ltd
- Introduction to Soil Microbiology – M. Alexander
- Agricultural Microbiology – N. Rangaswamy and D. J. Bagyaraj
- The Nature and Properties of Soils – N. C. Brady and R. R. Weil
- Biofertilizers in Agriculture - N. S. Subba Rao
- Microbiology-Michael J. Pelczar Jr, E. C. S. Chan and Noel R. Krieg

03. AGRICULTURAL ENGINEERING

- a. Course No : SWE-121 (Ag)
 b. Course title : Soil and Water Conservation Engineering
 c. Credit hour : 2(1+1)
 d. Class : 1st year B.Sc. (Hons.) Agril.
 e. Semester : 2nd Semester

SYLLABUS**Theory**

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

04. PLANT PHYSIOLOGY

- a. Course No : PP-121
- b. Course title : Fundamentals of Crop Physiology and Application
- c. Credit hour : 3(2+1)
- d. Class : 1st year B.Sc. (Hons.) Agril.
- e. Semester : 2nd Semester

SYLLABUS

Theory

Introduction to crop physiology and its importance in agriculture and horticultural crops; Plant cell: an overview; Diffusion and osmosis; Absorption of water, transpiration and stomatal physiology; Source- sink relationship in relation to crop yield, translocation of assimilates; Mineral nutrition of plants: Functions and deficiency symptoms of nutrients, nutrient uptake mechanisms; Photosynthesis: Light and dark reactions, C₃, C₄ and CAM plants; Respiration: Glycolysis, TCA cycle and electron transport chain; Fat metabolism: Fatty acid synthesis and breakdown; Plant growth regulators: Physiological roles and agricultural uses, Physiological aspects of growth and development of major crops: Growth analysis, Role of Physiological growth parameters in crop productivity; Photoperiodism and Vernalisation and its application in horticulture; Physiology of seed development and maturation; Physiology of seed and fruit growth and development, fruit setting, factors affecting fruit set and development, physiology of ripening of fruits-climacteric and non-climacteric fruits.

Practical

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

05. AGRONOMY

- a. Course No : AG-123
- b. Course title : Crop Geography and Ecology
- c. Credit hour : 2(2+0)
- d. Class : 1st year B.Sc. (Hons.) Agril.
- e. Semester : 2nd Semester

SYLLABUS

Theory

Historical evolution of agriculture, Basic concepts and principles in crop ecology, Response of crop plants to environment, Factors (Physical and social) determining crop distribution, Classification of climate- Koppen's Classification, Thornthwaite's Classification, Delineation of climatic zones of India, Bioclimatic zones, Physiological limits of crop yield and variability in relation to the ecological optimum, Photo and thermo-periodism, Crop adaptation-geographic distribution of crop plants, Adverse climatic effects and crop productivity, Manipulation of development physiology of crops, Crop phenology in relation

to eco-geographical conditions, Agro-ecological regions and agro-climatic zones of India and Odisha, Effects of global climate change on crop production.

06. PLANT PROTECTION

- a. Course No : PPT-121
- b. Course title : Fundamentals of Plant Pathology
- c. Credit hour : 3(2+1)
- d. Class : 1st year B.Sc. (Hons.) Agril.
- e. Semester : 2nd Semester

SYLLABUS

Theory

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

Fungi: General characters, definition of fungus, somatic structures, types of fungal thalli, fungal tissues, modifications of thallus, reproduction (asexual and sexual). Nomenclature, Binomial system of nomenclature, rules of nomenclature, classification of fungi. Key to divisions, sub-divisions, orders and classes. Bacteria and mollicutes: general morphological characters. Basic methods of classification and reproduction. Viruses: nature, architecture, multiplication and transmission. Study of phanerogamic plant parasites. Principles and methods of plant disease management. Nature, chemical combination, classification, mode of action and formulations of fungicides and antibiotics.

Practical

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

07. AGRICULTURAL ENTOMOLOGY

- a. Course No : ENT-121
- b. Course title : Fundamentals of Entomology
- c. Credit hour : 4(3+1)
- d. Class : 1st year B.Sc. (Hons.) Agril.
- e. Semester : 2nd Semester

SYLLABUS

Theory

Part-I: History of Entomology in India. Factors for insect's abundance. Major points related to dominance of Insecta in Animal kingdom. Classification of phylum Arthropoda

upto classes. Relationship of class Insecta with other classes of Arthropoda. Morphology: Structure and functions of insect cuticle and molting. Body segmentation. Structure of Head, thorax and abdomen. Structure and modifications of insect antennae, mouth parts, legs, Wing venation, modifications and wing coupling apparatus. Structure of male and female genital organ. Metamorphosis and diapause in insects. Types of larvae and pupae. Structure and functions of digestive, circulatory, excretory, respiratory, nervous, secretary (Endocrine) and reproductive system, in insects. Types of reproduction in insects. Major sensory organs like simple and compound eyes, chemoreceptor.

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

Part III: Pest surveillance and pest forecasting. Categories of pests. Host plant resistance, Cultural, Mechanical, Physical. Legislative. Biological (parasites, predators & transgenic plant pathogens such as bacteria, fungi and viruses) methods of control. Chemical control-importance, hazards and limitations. Classification of insecticides, toxicity of insecticides and formulations of insecticides. Recent methods of pest control, repellents, antifeedants, hormones, attractants, gamma radiation and genetic control. Practices, scope and limitations of IPM. Insecticides Act 1968-Important provisions. Application techniques of spray fluids. Phytotoxicity of insecticides. Symptoms of poisoning, first aid and antidotes. Beneficial insects: parasites and predators used in pest control. Important groups of microorganisms, bacteria, viruses and fungi used in pest control and their mass multiplication techniques. Important species of pollinators, weed killers and scavengers, their importance.

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

Practical

Methods of collection and preservation of insects including immature stages; External features of Grasshopper/Blister beetle; 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.

08. AGRICULTURAL EXTENSION

- a. Course No : EE-123
- b. Course title : Fundamentals of Agricultural Extension Education
- c. Credit hour : 3(2+1)
- d. Class : 1st year B.Sc. (Hons.) Agril.
- e. Semester : 2nd Semester

SYLLABUS

Theory

Education: Meaning, definition & Types; Extension Education- meaning, definition, scope and process; objectives and principles of Extension Education; Extension Programme planning- Meaning, Process, Principles and Steps in Programme Development. Extension systems in India: extension efforts in pre-independence era (Sriniketan, Marthandam, Firka Development Scheme, Gurgaon Experiment, etc.) and post-independence era (Etawah Pilot Project, Nilokheri Experiment, etc.); various extension/ agriculture development programmes launched by ICAR/ Govt. of India (IADP, IAAP, HYVP, KVK, IVLP, ORP, ND,NATP, NAIP, etc.). New trends in agriculture extension: privatization extension, cyber extension/ e-extension, market-led extension, farmer-led extension, expert systems, etc.

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

Practical

To get acquainted with university extension system. Group discussion- exercise; handling and use of audio visual equipments and digital camera and LCD projector; preparation and use of AV aids, preparation of extension literature – leaflet, booklet, folder, pamphlet news stories and success stories; Presentation skills exercise; micro teaching exercise; A visit to village to understand the problems being encountered by the villagers/ farmers; to study organization and functioning of DRDA and other development departments at district level; visit to NGO and learning from their experience in rural development; understanding PRA techniques and their application in village development planning; exposure to mass media: visit to community radio and television studio for understanding the process of programme production; script writing, writing for print and electronic media, developing script for radio and television

09. AGRICULTURAL EXTENSION

- a. Course No : EE-124
- b. Course title : Communication Skills and Personality Development
- c. Credit hour : 2(1+1)
- d. Class : 1st year B.Sc. (Hons.) Agril.
- e. Semester : 2nd Semester

SYLLABUS

Theory

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

Practical

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

SYLLABUS AND COURSE BREAKUP

IIIrd Semester, 2nd Year B.Sc.(Hons.) Agriculture

01. AGRONOMY

a. Course No	: AG-213
b. Course title	: Crop Production Technology-I(<i>Kharif Crops</i>)
c. Credit hour	: 2(1+1)
d. Class	: 2 nd year B.Sc. (Hons.) Agril.
e. Semester	: 1 st Semester

SYLLABUS

Theory

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

02. PLANT BRREDING & GENETICS

a. Course No	: PBG-212
b. Course title	: Fundamentals of Plant Breeding
c. Credit hour	: 3(2+1)
d. Class	: 2 nd year B.Sc. (Hons.) Agril.
e. Semester	: 1 st Semester

SYLLABUS

Theory:

Historical development, concept, nature and role of plant breeding, objectives of plant breeding, major achievements and future prospects; Genetics in relation to plant breeding, modes of reproduction, pollination and apomixes, self – incompatibility and male sterility-genetic consequences, cultivar options. Domestication, Acclimatization, introduction; Centre of origin/diversity. Component of Genetic variation; Heritability and genetic advance; Genetic basis and breeding methods in self- pollinated crops- mass and pure line selection,

pedigree, bulk, SSD and backcross methods, hybridization techniques and handling of segregating population; Multiline concept.

Concepts of population genetics and Hardy-Weinberg Law, Genetic basis and methods of breeding cross pollinated crops, modes of selection; Heterosis and inbreeding depression, development of inbred lines and hybrids, composite and synthetic varieties; Breeding methods in asexually propagated crops, clonal selection and hybridization; Wide hybridization and pre-breeding; Polyploidy in relation to plant breeding, mutation breeding-methods and uses;

Breeding for important biotic and abiotic stresses; Biotechnological tools-DNA markers and marker assisted selection. Participatory plant breeding; Development and release of varieties.

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 segregating populations. Methods of calculating mean, range, variance, standard deviation, heritability. Designs used in plant breeding experiment, analysis of Randomized Block Design components of genetic variance. To work out the mode of pollination in a given crop and extent of natural out crossing. Prediction of performance of double cross hybrids.

03. AGRICULTURAL ECONOMICS

- | | |
|-----------------|---|
| a. Course No | : AE-212 |
| b. Course title | : Agricultural Finance & Cooperation |
| c. Credit hour | : 3(2+1) |
| d. Class | : 2 nd year B.Sc. (Hons.) Agril. |
| e. Semester | : 1 st Semester |

SYLLABUS

Theory

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

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

Practical

Determination of most profitable level of capital use. Optimum allocation of limited amount of capital among different enterprise. Analysis of progress and performance of cooperatives using published data. Analysis of progress and performance of commercial banks and RRBs using published data. Visit to a commercial bank, cooperative bank and cooperative society to acquire firsthand knowledge of their management, schemes and procedures. Estimation of credit requirement of farm business – A case study. Preparation and analysis of balance sheet – A case study. Preparation and analysis of income statement – A case study. Appraisal of a loan proposal – A case study. Techno-economic parameters for preparation of projects. Preparation of Bankable projects for various agricultural products and its value added products. Seminar on selected topics.

04. AGRICULTURAL METEOROLOGY

- | | |
|-----------------|---|
| a. Course No | : AM-211 |
| b. Course title | : Introductory Agrometeorology Climate Change |
| c. Credit hour | : 2(1+1) |
| d. Class | : 2 nd year B.Sc. (Hons.) Agril. |
| e. Semester | : 1 st Semester |

SYLLABUS

Theory

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

Practical:

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

05. AGRICULTURAL ENGINEERING

- a. Course No : FMP(Ag)-211
- b. Course title : Farm Machinery and Power
- c. Credit hour : 2(1+1)
- d. Class : 2nd year B.Sc. (Hons.) Agril.
- e. Semester : 1st Semester

SYLLABUS

Theory

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

Practical

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

COURSE BREAKUP

(A) Theory lecture outline

Lecture No.	Topic
01	Status of Farm Power in India, Sources of Farm Power
02	I.C. engines, Working principles of I.C. engines, Comparison of two stroke and four stroke cycle engines
03	Study of different components of I. C. engine
04	Study of different components of I. C. engine
05	IC engine terminologies and problem solving
06	Familiarization of various systems of I.C. engine and study of air cleaning system of tractor engine
07	Study of lubrication and cooling system of a tractor engine
08	Study of fuel supply system of a tractor engine and hydraulic system of tractor
09	Familiarization of power transmission of tractor and study of clutch
10	Study of gear box, differential and final drive of tractor

Lecture No.	Topic
11	Study of various types of tractor and cost analysis of tractor and its attached implements
12	Familiarization with primary and secondary tillage implements, implement for hill agriculture and intercultural equipments
13	Study of sowing, and planting equipments, calibration of seed drills and problem solving.
14	Study of plant protection equipment
15	Study of harvesting and threshing equipment

(B) Practical class outline

Class No.	Exercise
01	Familiarization of different components of I. C. engine
02	Study of two stroke and four stroke cycle engines
03	Familiarization of air cleaning and cooling system of tractor
04	Familiarization of lubrication and fuel supply system of tractor
05	Familiarization of power transmission system of tractor such as clutch, gear box, differential and final drive.
06	Familiarization of brake, steering and hydraulic system of tractor
07	Learning of tractor driving
08	Familiarization with operation of power tiller
09	Familiarization of different types of primary tillage implements
10	Familiarization of different types of secondary tillage implements
11	Familiarization of different components of seed cum fertilizer drills, their seed metering mechanism and calibration
12	Familiarization of different components of planter and transplanter
13	Familiarization of various types of sprayers and dusters
14	Familiarization of different inter-cultivation equipment
15	Familiarization of different harvesting and threshing equipment

Reference books:

- Tractors and their Power Units- Barger EL, Liljedahl JB & McKibben EC
- Principles of Farm Machinery - Kepner RA, Bainer R & Berger EL
- Elements of Agricultural Engineering - Sahay Jagadhiswar
- Principles of Agricultural Engineering- Michel, A M and T P Ojha

06. HORTICULTURE

- a. Course No : Hort.-212
b. Course title : Production Technology for Vegetable and Spices
c. Credit hour : 2(1+1)
d. Class : 2nd year B.Sc. (Hons.) Agril.
e. Semester : 1st Semester

SYLLABUS

Theory

Importance of vegetables & spices in human nutrition and national economy, brief about origin, area, production, improved varieties and cultivation practices such as time of

sowing, sowing, transplanting techniques, planting distance, fertilizer requirements, irrigation, weed management, harvesting, storage, physiological disorders, disease and pest control and seed production of important vegetable and spices.

Practical

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

07. SOIL SCIENCE AND AGRICULTURAL CHEMISTRY

- | | |
|-----------------|---|
| a. Course No | : AC-213 |
| b. Course title | : Environmental Science and Disaster Management |
| c. Credit hour | : 3(2+1) |
| d. Class | : 2 nd year B.Sc. (Hons.) Agril. |
| e. Semester | : 1 st Semester |

SYLLABUS

Theory

Multidisciplinary nature of environmental studies Definition, scope and importance. Natural Resources: Renewable and non-renewable resources, Natural resources and associated problems. a) Forest resources: Use and over-exploitation, deforestation, case studies. Timber extraction, mining, dams and their effects on forest and tribal people. b) Water resources: Use and over-utilization of surface and ground water, floods, drought, conflicts over water, dams-benefits and problems. c) Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources, case studies. d) Food resources: World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, case studies. e) Energy resources: Growing energy needs, renewable and non-renewable energy sources, use of alternate energy sources. Case studies. f) Land resources: Land as a resource, land degradation, man induced landslides, soil erosion and desertification. • Role of an individual in conservation of natural resources. • Equitable use of resources for sustainable lifestyles. Ecosystems: Concept of an ecosystem, Structure and function of an ecosystem, Producers, consumers and decomposers, Energy flow in the ecosystem. Ecological succession, Food chains, food webs and ecological pyramids. Introduction, types, characteristic features, structure and function of the following ecosystem: a. Forest ecosystem b. Grassland ecosystem c. Desert ecosystem d. Aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries)

Biodiversity and its conservation: - Introduction, definition, genetic, species & ecosystem diversity and biogeographical classification of India. Value of biodiversity: consumptive use, productive use, social, ethical, aesthetic and option values. Biodiversity at global, National and local levels, India as a mega-diversity nation. Hot-spots of biodiversity. Threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts. Endangered and endemic species of India. Conservation of biodiversity: In-situ and Ex-situ conservation of biodiversity.

Environmental Pollution: definition, cause, effects and control measures of: a. Air pollution b. Water pollution c. Soil pollution d. Marine pollution e. Noise pollution f.

Thermal pollution g. Nuclear hazards. Solid Waste Management: causes, effects and control measures of urban and industrial wastes. Role of an individual in prevention of pollution. Social Issues and the Environment: From Unsustainable to Sustainable development, Urban problems related to energy, Water conservation, rain water harvesting, watershed management. Environmental ethics: Issues and possible solutions, climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust. dies. Wasteland reclamation. Consumerism and waste products. Environment Protection Act. Air (Prevention and Control of Pollution) Act. Water (Prevention and control of Pollution) Act. Wildlife Protection Act. Forest Conservation Act. Issues involved in enforcement of environmental legislation. Public awareness.

Human Population and the Environment: population growth, variation among nations, population explosion, Family Welfare Programme. Environment and human health: Human Rights, Value Education, HIV/AIDS. Women and Child Welfare. Role of Information Technology in Environment and human health.

Disaster management

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

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

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

Practical

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

08. AGRICULTURE BIOTECHNOLOGY

k. Course No	: ABT-211
l. Course title	: Fundamentals of Plant Biochemistry and Biotechnology
m. Credit hour	: 3(2+1)
n. Class	: 2 nd year B.Sc. (Hons.) Agril.
o. Semester	: 1 st Semester

SYLLABUS

Theory

Importance of Biochemistry. Properties of Water, pH and Buffer. Carbohydrate: Importance and classification. Structures of Monosaccharides, Reducing and oxidizing properties of Monosaccharides, Mutarotation; Structure of Disaccharides and Polysaccharides. Lipid: Importance and classification; Structures and properties of fatty

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

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

Practical

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. 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.

09. ANIMAL HUSBANDRY

- | | |
|-----------------|---|
| a. Course No | : LPM-211 |
| b. Course title | : Livestock & Poultry Management |
| c. Credit hour | : 4(3+1) |
| d. Class | : 2 nd year B.Sc. (Hons.) Agril. |
| e. Semester | : 1 st Semester |

SYLLABUS

Theory

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

Practical

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

SYLLABUS AND COURSE BREAKUP

IVth Semester, 2nd Yr. B.Sc. (Hons.) Agriculture

01. AGRONOMY

f. Course No	: AG-225
g. Course title	: Crop Production Technology-II(Rabi Crops)
h. Credit hour	: 2(1+1)
i. Class	: 2 nd year B.Sc. (Hons.) Agril.
j. Semester	: 2 nd Semester

SYLLABUS

Theory

Origin, geographical distribution, economic importance, soil and climatic requirements, varieties, cultural practices and yield of *Rabi* crops; cereals –wheat and barley ;oilseeds-rapeseed, mustard and sunflower; pulses-chickpea, lentil, peas, sugar crops-sugarcane; Forage crops- lucerne and oat; package of practices of berseem ,safflower sugarbeet, opium poppy taramira, linseed; medicinal and aromatic crops-mentha, lemon grass and citronella,.

Practical

Sowing of rabi crops and their identification , 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.

02. HORTICULTURE

a. Course No	: HORT-223
b. Course title	: Production Technology for Ornamental Crops, MAP and Landscaping
c. Credit hour	: 2(1+1)
d. Class	: 2 nd year B.Sc. (Hons.) Agril.
e. Semester	: 2 nd Semester

SYLLABUS

Theory

Importance and scope of ornamental crops, medicinal and aromatic plants and landscaping. Principles of landscaping. Landscape uses of trees, shrubs and climbers. Production technology of important cut flowers like rose, gerbera, and carnation, under protected conditions and gladiolus, tuberose, chrysanthemum under open conditions. Package of practices for loose flowers like marigold and jasmine under open conditions. Production technology of important medicinal plants like ashwagandha, asparagus, safed musli, aloe, 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. Propagation of Ornamental and MAPs, 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.

03. AGRICULTURAL ENGINEERING

- a. Course No : FMP(Ag)-222
- b. Course title : Renewable Energy and Green Technology
- c. Credit hour : 2(1+1)
- d. Class : 2nd year B.Sc. (Hons.) Agril.
- e. Semester : 2nd Semester

SYLLABUS

Theory

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

Practical

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

04. SOIL SCIENCE & AGRICULTURAL CHEMISTRY

- a. Course No : AC-224
- b. Course title : Problematic Soils and their Management
- c. Credit hour : 2(1+1)
- d. Class : 2nd year B.Sc. (Hons.) Agril.
- e. Semester : 2nd Semester

SYLLABUS

Theory

Soil quality and health, distribution of Waste land and problem soils in different agro ecosystem of India. Their categorization based on properties. Reclamation and management of Saline and sodic soils, Acid soils, Acid Sulphate soils, highly and low permeable soils. Remote sensing and GIS in diagnosis and management of problem soils. Bio remediation of

soils through multipurpose trees (MPTs) , land capability and suitability classification. Irrigation water – quality and standards, utilization of saline water in agriculture.

Practical

Characterization of acid, acid sulfate, salt-affected and calcareous soils. Determination of cations (Na^+ , K^+ , Ca^{+2} and Mg^{+2}) in irrigation water and soil samples. Determination of anions (Cl^- , SO_4^{2-} , CO_3^{2-} and HCO_3^-) in irrigation waters and soil samples. Determination of CaCO_3 in calcareous soils. Lime requirements of acid soil and gypsum requirements of sodic soil. Computation of SAR and RSC of irrigation water.

05. HORTICULTURE

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|-----------------|--|
| a. Course No | : HORT-224 |
| b. Course title | : Production Technology for Fruit and Plantation Crops |
| c. Credit hour | : 2(1+1) |
| d. Class | : 2 nd year B.Sc. (Hons.) Agril. |
| e. Semester | : 2 nd Semester |

SYLLABUS

Theory

Importance, introduction and scope of horticulture. Classification of fruits according to climate. Selection of site, planning, establishment and layout of orchard. Propagation methods of fruit crops. Methods of training and pruning in fruit crops. Use of growth regulators in fruit production. Package of practices for the cultivation of major fruits with the emphasis on botanical name, family, origin, distribution, climate, soil, varieties, propagation, planting, manures and fertilizers, irrigation, training and pruning, intercultural operation, harvesting, yield and plant protection measures including physiological disorders – mango, banana, citrus, grape, guava, sapota, apple, papaya, pineapple, pomegranate, ber, jack, aonla, bael, date palm; plantation crops -coconut, areca nut, cashew, oil palm and tea.

Practical

Identification of fruit and plantation crops. Study of horticultural tools and implements and their uses; Plant propagation methods, by seeds, cuttings (soft wood, hard wood and semi-hardwood), budding and grafting, layering (simple layering, Air layering,); Layout and planting systems, Methods of pruning and training of important fruit crops .Irrigation methods in fruit crops including drip – Micro irrigation methods for establishment of orchard; Methods of fertilizer application in fruit crops. Visit to local commercial orchards with in state; Preparation of growth regulator solutions for propagation; Application of growth regulators for improving fruit set, fruit size and quality.

06. SEED SCIENCE & TECHNOLOGY

- | | |
|-----------------|---|
| a. Course No | : SST-221 |
| b. Course title | : Principles of Seed Science & Technology |
| c. Credit hour | : 2(1+1) |
| d. Class | : 2 nd year B.Sc. (Hons.) Agril. |
| e. Semester | : 2 nd Semester |
| f. | |

SYLLABUS

Theory

Seed and Seed Technology – Introduction, definition and importance. Seed quality – concept, characteristics and classes of quality seed, system of seed quality control. Deterioration of crop varieties – factors affecting deterioration and their control. General principles of quality seed production in open-pollinated varieties and hybrids of crops. Seed processing – objective, planning and layout of processing plant, sequence of operations. Seed drying – need, methods, principles of forced air drying, types and operation of seed dryers. Seed cleaning and grading – pre-cleaning/pre-conditioning equipments and their use, basic seed cleaning using air screen machine, upgrading equipments and their use. Seed treatment – importance, methods, equipments and chemicals used. Seed packaging – types of packaging materials, criteria of selection, packaging equipments. Seed storage – general principles, stages, factors affecting seed longevity during storage, measures for controlling moisture, temperature and storage pests. Seed marketing – structure and organisation, sales generation activities, factors affecting seed marketing, role of WTO and OECD in seed marketing. Seed certification – phases, field and seed inspection procedure, duties and powers of the Seed Inspectors, offences and penalties. GM crops and organic seed production. Seed legislation – Seeds Act, 1966, Seed Act enforcement, Seeds (Control) Order, 1983 and PPV & FR Act, 2001.

Practical

Study of foundation and certified seed production techniques in rice, wheat, maize, green gram, black gram, pigeon pea, sesamum, groundnut, rapeseed and mustard, soybean, sunflower, cotton, potato, tomato, brinjal, chillies, okra, cucumber, onion, and napier grass. Visit to seed production farm, processing plant and storage go down.

07. AGRONOMY

- | | |
|-----------------|--|
| a. Course No | : AG-226 |
| b. Course title | : Farming system and sustainable agriculture |
| c. Credit hour | : 1(1+0) |
| d. Class | : 2 nd year B.Sc. (Hons.) Agril. |
| e. Semester | : 2 nd Semester |

SYLLABUS

Theory

Farming System-scope, importance, and concept, Types and systems of farming system and factors affecting types of farming, Farming system components and their maintenance, Cropping system and pattern, multiple cropping system, Efficient cropping system and their evaluation, Allied enterprises and their importance, Tools for determining production and efficiencies in cropping and farming system; Sustainable agriculture-problems and its impact on agriculture, indicators of sustainability, adaptation and mitigation, conservation agriculture strategies in agriculture, HEIA, LEIA and LEISA and its techniques for sustainability, Integrated farming system-historical background, 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.

08. AGRICULTURAL RECONOMICS

- a. Course No : AE-223
- b. Course title : Agricultural Marketing, Trade and Prices
- c. Credit hour : 3(2+1)
- d. Class : 2nd year B.Sc. (Hons.) Agril.
- e. Semester : 2nd Semester

SYLLABUS

Theory

Agricultural Marketing: Concepts and definitions of market, marketing, agricultural marketing, market structure, marketing mix and market segmentation, classification and characteristics of agricultural markets; demand, supply and producer's surplus of agri-commodities: nature and determinants of demand and supply of farm products, producer's surplus – meaning and its types, marketable and marketed surplus, factors affecting marketable surplus of agri-commodities; product life cycle (PLC) and competitive strategies: Meaning and stages in PLC; characteristics of PLC; strategies in different stages of PLC; pricing and promotion strategies: pricing considerations and approaches – cost based and competition based pricing; market promotion – advertising, personal selling, sales promotion and publicity – their meaning and merits & demerits; marketing process and functions: Marketing process-concentration, dispersion and equalization; exchange functions – buying and selling; physical functions – storage, transport and processing; facilitating functions – packaging, branding, grading, quality control and labeling (Agmark); Market functionaries and marketing channels: Types and importance of agencies involved in agricultural marketing; meaning and definition of marketing channel; number of channel levels; marketing channels for different farm products; Integration, efficiency, costs and price spread: Meaning, definition and types of market integration; marketing efficiency; marketing costs, margins and price spread; factors affecting cost of marketing; reasons for higher marketing costs of farm commodities; ways of reducing marketing costs; Role of Govt. in agricultural marketing: Public sector institutions- CWC, SWC, FCI, CACP & DMI – their 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.

09. AGRICULTURAL STATISTICS & COMPUTER APPLICATION IN AGRICULTURE

- a. Course No : AM-222
- b. Course title : Agriculture Informatics
- c. Credit hour : 3(1+2)
- d. Class : 2nd year B.Sc. (Hons.) Agril.
- e. Semester : 2nd Semester

SYLLABUS

Theory

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

Practical

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

10. PLANT PROTECTION

- a. Course No : NEM-221
- b. Course title : Introductory Nematology
- c. Credit hour : 2(1+1)
- d. Class : 2nd year B.Sc. (Hons.) Agril.
- e. Semester : 2nd Semester

SYLLABUS

Theory

History and economic importance of plant parasitic nematodes; Characters of Phylum Nematoda and systematic position of plant parasitic nematodes (outline classification upto

Generic level); General morphology, ecology and biology; Plant nematode relationship; Kinds of parasitism and symptomology; Nematode interaction with other micro-organisms; Nematode diseases of crop plants of economic importance in State with special reference to *Meloidogyne* spp; *Heterodera avenae*, *Anguina tritici* and *Rotylenchulus reniformis* *Tylenchulus semipenetrans*; Principles of nematode management.

Practical

Study of compound microscope alongwith other laboratory necessities, Survey and Collection of soil and plant samples, extraction of nematodes from soil and roots, killing and fixing of nematodes, staining and separation of nematodes in plants tissue, preparation of temporary and semi-permanent mounts of nematodes, identification of important plant parasitic nematodes, collection and preservation of nematode diseased plant samples; Nematicides and their uses.

11. SOIL SCIENCE & AGRICULTURAL CHEMISTRY

- | | |
|-----------------|---|
| a. Course No | : AC(E)-221 |
| b. Course title | : Agrochemicals |
| c. Credit hour | : 3(2+1) |
| d. Class | : 2 nd year B.Sc. (Hons.) Agril. |
| e. Semester | : 2 nd Semester |

SYLLABUS

Theory

An introduction to agrochemicals, their type and role in agriculture, effect on environment, soil, human and animal health, merits and demerits of their uses in agriculture, management of agrochemicals for sustainable agriculture. Herbicides-Major classes, properties and important herbicides. Fate of herbicides. Fungicides - Classification – Inorganic fungicides - characteristics, preparation and use of sulfur and copper, Mode of action-Bordeaux mixture and copper oxychloride. Organic fungicides- Mode of action-Dithiocarbamates-characteristics, preparation and use of Zineb and maneb. Systemic fungicides- Benomyl, carboxin, oxycarboxin, Metalaxyl, Carbendazim, characteristics and use. Introduction and classification of insecticides: inorganic and organic insecticides Organochlorine, Organophosphates, Carbamates, Synthetic pyrethroids Neonicotinoids, Biorationals, Insecticide Act and rules, Insecticides banned, withdrawn and restricted use, Fate of insecticides in soil & plant. IGRs Biopesticides, Reduced risk insecticides, Botanicals, plant and animal systemic insecticides their characteristics and uses. Fertilizers and their importance. Nitrogenous fertilizers: Feedstocks and Manufacturing of ammonium sulphate, ammonium nitrate, ammonium chloride, urea. Slow release N-fertilizers. Phosphatic fertilizers: feedstock and manufacturing of single superphosphate. Preparation of bone meal and basic slag. Potassic fertilizers: Natural sources of potash, manufacturing of potassiumchloride, potassium sulphate and potassium nitrate. Mixed and complex fertilizers: Sources and compatibility–preparation of major, secondary and micronutrient mixtures. Complex fertilizers: Manufacturing of ammonium phosphates, nitrophosphates and NPK complexes. Fertilizer control order. Fertilizer logistics and marketing. Plant bio-pesticides for ecological agriculture, Bio-insect repellent.

Practical

Sampling of fertilizers and pesticides. Pesticides application technology to study about various pesticides appliances. Quick tests for identification of common fertilizers. Identification of anion and cation in fertilizer. Calculation of doses of insecticides to be used. To study and identify various formulations of insecticide available in 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 Muriate 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.

12. AGRONOMY

- a. Course No : AG(E)-221
- b. Course title : Water management & micro-irrigation
- c. Credit hour : 3(2+1)
- d. Class : 2nd year B.Sc. (Hons.) Agril.
- e. Semester : 2nd Semester

SYLLABUS

(A) Theory lecture outline

Lecture No.	Topic	Details
01	Irrigation: definition and objective	Hydrological cycle, Rainfall, evaporation pattern and water balance in India. Sources of water for crop plants. Definitions of Irrigation, Objectives.
02	Water resources	Water resources: Water resources of India and Odisha: Surface water resources, Ground water resources. Spatial and Temporal distribution of water resources
03		Irrigation sources: Indian scenario, Odisha scenario. History of irrigation in Indian agriculture. Importance of irrigation in Indian economy.
04	Irrigation development in India and Orissa	Irrigation development in India : Major, medium and minor irrigation projects. Irrigation potentials. Irrigated area of Indian states. Irrigated areas under principal crops.
05	Soil water relationships	Soil-Water relationship: Soil as a system.; Forces acting on soil water: Soil water Tension and Soil water Stress. Energy concept of soil water.
06		Soil Water potential concept. Total soil water potential, Gravitational potential, Pressure potential, Osmotic potential, Other potentials.
07		Forms and occurrence of soil water. Classification of soil water. Soil Water constants. Soil water retention. Soil characteristics influencing water retention. Available soil moisture.
08	Soil water movement	Flow of water into the soil. Infiltration process, Infiltration rate, Infiltration capacity, Cumulative infiltration; Factors influencing infiltration. Infiltration in layered soils.
09		Movement of water in soils: Water movement in Saturated and Unsaturated soil . Hydraulic conductivity. Variability

Lecture No.	Topic	Details
		between soil layers. Water vapour movement.
10	Methods of soil moisture estimation	Soil water measurement: Feel and appearance method, Gravimetric method, Tensiometric method, Pressure plate apparatus, Thermocouple psychrometer; Electric resistance block, Neutron scattering method.
11	Plant water relationships	Role of water in plants. Water absorption by plants: Root growth and water absorption; Energy concept of water absorption. Water in soil-plant-atmosphere system and its path way. Transpiration.
12		Water and plant process: Soil moisture extraction pattern. Moisture sensitive periods. Water deficit and plant responses. Concepts of soil water availability to plants .
13	Evapotranspiration	Evaporation, transpiration and evapotranspiration; Evapotranspiration and consumptive use.
14		PET, Reference ET, Crop ET...Crop coefficients for estimating ETcrop. Factors affecting evapotranspiration: Soil factors, Crop factor, climatic factors
15		Methods of estimating evapotranspiration: Direct methods- Transpiration ratio method, Depth-interval-yield approach, Lysimetry, Field experimentation method, Soil water depletion method, Water balance method.
16		Indirect methods of estimating evapotranspiration: Pan evaporation method, Blaney-criddle formula, Thornthwaite formula, Penman formula, modified Penman formula, FAO Penman-Monteith method, Radiation method.
17	Crop water requirement	Water requirement of crops on demand basis & source basis; Net irrigation requirement, Gross irrigation requirement, irrigation period, Design irrigation frequency, Frequency and interval of irrigation;
18		Depth of irrigation, factors affecting irrigation depth. Kor watering, Kor depth, Kor period, Palco; Crop period, Base period, Delta of water, Duty of water; Duty and Delta relations.
19	Effective rainfall	Effective rainfall, Factors influencing effective rainfall. Methods of determining effective rainfall- soil moisture change method, drum culture technique, empirical methods.
20	Scheduling of irrigation	Scheduling irrigation: Objective and advantages. Approaches/criteria for scheduling irrigation. Soil criteria-soil water content approach, depth-interval approach, critical level approach, soil water tension approach, electrical resistance approach.
21		Scheduling irrigation: Plant criteria- plant appearance, leaf water potential, stomatal resistance, leaf temperature, critical stages of water need of crops, climatological approach-empirical formula, evaporimeter, IW-CPE ratio approach
22	Methods of irrigation:	Complicacy in irrigation, classification of irrigation methods, suitability, advantages and limitations, efficiency

Lecture No.	Topic	Details
		of irrigation methods
23	Surface and subsurface	Surface and subsurface irrigation methods. Wild flooding, controlled flooding: Check flooding, Basin flooding, Border strip flooding, and Furrow flooding. Modification in flood irrigation
	Micro irrigation, sprinkler and drip irrigation	Micro irrigation- sprinkler and drip irrigation; Components of drip and sprinkler system. Suitability, Advantages, Limitations and Efficiency; comparison between drip and sprinkler irrigation, comparison with other irrigation methods.
24	Irrigation efficiency and water use efficiency	Introduction, Reservoir storage efficiency, conveyance efficiency, application efficiency, distribution efficiency, storage efficiency, Project efficiency, Operational efficiency, Economic irrigation efficiency. Water Use Efficiency, Crop WUE, Field WUE.
25	Irrigation water quality and its management	Irrigation water quality: origin of salts, Salinity hazard, Alkaline hazard, Sodicity hazard. (Boron) Toxicity hazard; Indicators. classification of irrigation water on the basis of quality
26		Growing crops in salt affected areas, Salt tolerant limits and crops. Guidelines for using poor quality irrigation water.
27	Conjunctive use of water	Quality of surface and ground water. Leaching requirement. Management of poor quality water. Conjunctive use of surface and ground water.
28	Water requirement of crops	Water requirement of crops: Rice, Wheat, Maize, Pigeonpea, Greengram, Blackgram, Pea, Chickpea, Lentil, Sugarcane
29		Water requirement of crops: Groundnut, Sunflower, Rapeseed and Mustard, Cotton, Potato, Onion, Tomato, Mango, Banana
30	Agricultural drainage	Causes of water logging and development of high water table, Problems of excess irrigation. Signs of poor drainage, Effect of water logging. Benefits of drainage. Drainage coefficient,
31		Methods of drainage: Surface drainage, Systems of surface drains: Subsurface drains; Other types of drainage devices: Mole drain, Pole /Bamboo drain, Stone drain, Drainage by wells, Drainage by pumps, Bio-drainage.
32	On farm water management	On-farm water management: Participatory irrigation management: objectives, opportunities, Functions of farmers organization at different levels.
	Water trading	Water rights- Land based water rights, Use based water rights. Water trading: Definition, virtual water, water trading by different countries, Economics

13. HORTICULTURE

f. Course No	: HORT(E)-221
g. Course title	: Landscaping
h. Credit hour	: 3(2+1)
i. Class	: 2 nd year B.Sc. (Hons.) Agril.
j. Semester	: 2 nd Semester

SYLLABUS

Theory

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

Practical

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

14. COMMERCIAL PLANT BREEDING

a. Course No	: PBG(E)-221
b. Course title	: Commercial Plant Breeding
c. Credit hour	: 3(1+2)
d. Class	: 2 nd year B.Sc. (Hons.) Agril.
e. Semester	: 2 nd Semester

SYLLABUS

Theory

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

breeding: DUS testing and registration of varieties under PPV & FR Act. Variety testing, release and notification systems in India. Principles and techniques of seed production, types of seeds, quality testing in self and cross pollinated crops.

Practical

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

SYLLABUS AND COURSE BREAKUP

Vth Semester, 3rd Year B.Sc. (Hons.) Agriculture

01. PLANT PROTECTION

k. Course No	: PPT-312
l. Course title	: Principles of Integrated Pest & Disease Management
m. Credit hour	: 3(2+1)
n. Class	: 3 rd year B.Sc. (Hons.) Agril.
o. Semester	: 1 st Semester

SYLLABUS

Theory

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

Practical

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

02. SOIL SCIENCE & AGRICULTURAL CHEMISTRY

a. Course No	: AC-315
b. Course title	: Manures, Fertilizers & Soil Fertility Management
c. Credit hour	: 3(2+1)
d. Class	: 3 rd year B.Sc. (Hons.) Agril.
e. Semester	: 1 st Semester

SYLLABUS

Theory

History of soil fertility and plant nutrition. Criteria of essentiality, role, deficiency and toxicity symptoms of essential plant nutrients, Mechanisms of nutrient transport to

plants, factors affecting nutrient availability to plants. Chemistry of soil nitrogen, phosphorus, potassium, calcium, magnesium, sulphur and micronutrients. Soil fertility evaluation, Soil testing. Critical levels of different nutrients in soil. Forms of nutrients in soil, plant analysis, rapid plant tissue tests. Indicator plants. Methods of fertilizer recommendations to crops. Factor influencing nutrient use efficiency (NUE), methods of application under rainfed and irrigated conditions. Integrated nutrient management.

Introduction and importance of organic manures, properties and methods of preparation of bulky and concentrated manures. Green/leaf manuring. Chemical fertilizers: Classification, composition and properties of major nitrogenous, phosphatic, potassic fertilizers, secondary & micronutrient fertilizers, Complex fertilizers, Nano fertilizers Soil amendments, Fertilizer Storage, Fertilizer Control Order.

Practical

Introduction of analytical instruments and their principles, calibration and applications, Colorimetry and flame photometry. Estimation of available N, P, K, S, Ca & Mg in soils. Collection, Processing & Storage of manures/ fertilizer samples, Estimation of Nutrient contents (N, P, and K) in manures/fertilizers samples. Quick tests for identification of common fertilizers. Estimation of N, P & K in plants.

03. AGRICULTURAL ENTOMOLOGY

- a. Course No : ENT-312
- b. Course title : Pests of crops, stored grain and their management
- c. Credit hour : 3(2+1)
- d. Class : 3rd year B.Sc. (Hons.) Agril.
- e. Semester : 1st Semester

SYLLABUS

Theory

General account on nature and type of damage by different arthropod pests; Scientific name, order, family, host range, distribution, biology and bionomics, nature of damage and management of major pests and scientific name, order, family, host range, distribution, nature of damage and control practice other than important arthropod pests of various field crops; cereals (Rice, Maize, Ragi, Wheat, Sorghum, Sugarcane); Pulses (Arhar, Blackgram, Greengram, Bengal gram); Oilseeds (Groundnut, Sesamum, Sunflower, Castor, Mustard); Fibre Crops (Cotton, Jute, Mesta, Sunnhemp); Vegetables:-Solanaceous vegetables (Brinjal, Tomato, Chilli); Tuber crops (Potato, Sweet potato); Cole crops (Cabbage, Cauliflower, Radish, Knolkhol); Cucubitaceous crops (Pumpkin, Cucumber, other gourds); Other vegetables (Okra, Bean), Fruit crops (Mango, Citrus, Banana, Pomegranate, Litchi, Ber, Guava, Papaya); Temperate fruits (Apple, Grape); Plantation crop(Coconut, Cashewnut, Tea, Coffee); Spices and condiments (Onion, Garlic, Cardamom, Blackpepper, Turmeric, Ginger.); Ornamental crops (Rose, Chrysanthemum, Marigold, Jasmine). Factors affecting losses of stored grain and role of physical, biological, mechanical and chemical factors in deterioration of grain; Insect pests, mites, rodents, birds and microorganisms associated with stored grain and their management. Storage structure and methods of grain storage and fundamental principles of grain store management.

Practical

Identification of different types of damage: identification and study of life cycle and seasonal history of various insect pests attacking crops and their produce: (a) field crops, (b) vegetable crops, (c) fruit crops, (d) plantation, spices and condiments; Identification of insect

pests and mites associated with stored grain; Determination of insect infestation by different methods. Assessment of losses due to insects; Calculations on the doses of insecticide application techniques; Fumigation of grain store/go-downs; Identification of rodents and rodent control operations in go-downs; Identification of birds and bird control operations in go-downs; Determination of moisture content of grain; Methods of grain sampling under storage condition; Visit to nearest FCI go-downs.

04. PLANT PROTECTION

- a. Course No : PPT-313
- b. Course title : Diseases of Field and Horticultural crops and their management-1
- c. Credit hour : 3(2+1)
- d. Class : 3rd year B.Sc. (Hons.) Agril.
- e. Semester : 1st Semester

SYLLABUS

Theory

Symptoms, etiology, disease cycle and management of major diseases of following crops: Field Crops: Rice: blast, brown spot, bacterial blight, sheath blight, false smut, khaira and tungro; Maize: stalk rots, downy mildew, leaf spots; Sorghum: smuts, grain mold and anthracnose, Bajra :downy mildew and ergot; Groundnut: early and late leaf spots, wilt Soybean: Rhizoctonia

blight, bacterial spot, seed and seedling rot and mosaic; Pigeonpea: Phytophthora blight, wilt and sterility mosaic; Finger millet: Blast and leaf spot; black & green gram: Cercospora leaf spot and anthracnose, web blight and yellow mosaic; Castor: Phytophthora blight; Tobacco: black shank, black root rot and mosaic. Horticultural Crops: Guava: wilt and anthracnose; Banana: Panama wilt, bacterial wilt, Sigatoka and bunchy top; Papaya: foot rot, leaf curl and mosaic, Pomegranate: bacterial blight; Cruciferous vegetables: Alternaria leaf spot. black rot; Brinjal: Phomopsis blight and fruit rot and Sclerotinia blight; Tomato: damping off, wilt, early and late blight, buck eye rot and leaf curl and mosaic; Okra: Yellow Vein Mosaic; Beans: anthracnose and bacterial blight; Ginger: soft rot; Colocasia: Phytophthora blight; Coconut: wilt and bud rot; Tea: blister blight; Coffee: rust

Practical

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

05. PLANT BREEDING & GENETICS

- a. Course No : PBG-313
- b. Course title : Crop Improvement – I (*Kharif*)
- c. Credit hour : 2(1+1)
- d. Class : 3rd year B.Sc. (Hons.) Agril.
- e. Semester : 1st Semester

SYLLABUS

Theory

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

Cereals: Rice, maize, sorghum and bajra

Pulses: Urd, mung, cowpea, pigeonpea and moth bean

Oilseeds: Soybean, sesame and groundnut

Fibre crops: Cotton

Fodder: Bajra, sorghum, maize

Vegetables: Chilli and tomato

Cash/ other crops: Castor

Hybrid seed production technology in Maize, Rice, Sorghum, Pearl millet and Pigeonpea, etc. Ideotype concept and climate resilient crop varieties for future.

Practical

Emasculation and hybridization techniques in different crop species; viz., Rice, Maize, Sorghum, Pearl Millet, Pigeonpea, Urdbean, Mungbean, Soybean, Groundnut, Sesame, Castor, Cotton, Cowpea and Pearl millet. 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.

6. AGRICULTURAL ECONOMICS

- | | |
|-----------------|--|
| a. Course No | : AE-314 |
| b. Course title | : Farm Management, Production and Resource Economics |
| c. Credit hour | : 2(1+1) |
| d. Class | : 3 rd year B.Sc. (Hons.) Agril. |
| e. Semester | : 1 st Semester |

SYLLABUS

Theory

Meaning and concept of farm management, objectives and relationship with other sciences. Meaning and definition of farms, its types and characteristics, factor determining types and size of farms. Principles of farm management: concept of production function and its type, use of production function in decision-making on a farm, factor-product, factor-

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

Practical

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

07. SEED SCIENCE & TECHNOLOGY

- | | |
|-----------------|---|
| a. Course No | : SST-312 |
| b. Course title | : Seed Quality Testing |
| c. Credit hour | : 1(0+1) |
| d. Class | : 3 rd year B.Sc. (Hons.) Agril. |
| e. Semester | : 1 st Semester |

SYLLABUS

Practical

Seed testing- objectives, types of seed quality tests, management of seed testing works in STL; Seed sampling-procedure of drawing samples and preparation of working samples; Moisture estimation; Purity analysis and related tests; Germination test; Seed viability test; Assessment of seed vigour; Genetic purity testing-laboratory (chemical, biochemical and molecular) methods and field plot (grow out) test; Seed health testing for pathogens and insect damage; Detection of GM seeds.

8. AGRONOMY

- a. Course No : AG-317
- b. Course title : Geoinformatics and Nano-technology for Precision Farming
- c. Credit hour : 2(1+1)
- d. Class : 3rd year B.Sc. (Hons.) Agril.
- e. Semester : 1st Semester

SYLLABUS

Theory

Precision agriculture: concepts and techniques; their issues and concerns for Indian agriculture; Geo-informatics- definition, concepts, tool and techniques; their use in Precision Agriculture. Crop discrimination and Yield monitoring, soil mapping; fertilizer recommendation using geospatial technologies; Spatial data and their management in GIS; 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.

Practical

Introduction to GIS software, spatial data creation and editing. Introduction to image processing software. Visual and digital interpretation of remote sensing images. Generation of spectral 84 85 Report of the ICAR Fifth Deans' Committee Report of the ICAR Fifth Deans' Committee profiles of different objects. Supervised and unsupervised classification and acreage estimation. Multispectral remote sensing for soil mapping. Creation of thematic layers of soil fertility based on GIS. Creation of productivity and management zones. Fertilizers recommendations based of VRT and STCR techniques. Crop stress (biotic/abiotic) monitoring using geospatial technology. Use of GPS for agricultural survey. Formulation, characterization and applications of nanoparticles in agriculture. Projects formulation and execution related to precision farming.

09. AGRONOMY

- a. Course No : CP-311
- b. Course title : Practical Crop Production-I (Kharif crops)
- c. Credit hour : 2(0+2)
- d. Class : 3rd year B.Sc. (Hons.) Agril.
- e. Semester : 1st Semester
- f. General objective :
- g. Specific objective :

SYLLABUS

Practical

Crop planning, raising field crops in multiple cropping systems: Field preparation, seed, treatment, nursery raising, sowing, nutrient, water and weed management and management of insect-pests diseases of crops, harvesting, threshing,

drying winnowing, storage and marketing of produce. The emphasis will be given to seed production, mechanization, resource conservation and integrated nutrient, insect-pest and disease management technologies. Preparation of balance sheet including cost of cultivation, net returns per student as well as per team of 8-10 students.

10. PLANT BREEDING & GENETICS

- a. Course No : PBG-314
- b. Course title : Intellectual Property Rights
- c. Credit hour : 1(1+0)
- d. Class : 3rd year B.Sc. (Hons.) Agril.
- e. Semester : 1st Semester

SYLLABUS

Theory

Introduction and meaning of intellectual property, brief introduction to GATT, WTO, TRIPs and WIPO, Treaties for IPR protection: Madrid protocol, Berne Convention, Budapest treaty, etc. Types of Intellectual Property and legislations covering IPR in India:-Patents, Copyrights, Trademark, Industrial design, Geographical indications, Integrated circuits, Trade secrets. Patents Act 1970 and Patent system in India, patentability, process and product patent, filing of patent, patent specification, patent claims, Patent opposition and revocation, infringement, Compulsory licensing, Patent Cooperation Treaty, Patent search and patent database. Origin and history including a brief introduction to UPOV for protection of plant varieties, Protection of plant varieties under UPOV and PPV&FR Act of India, Plant breeders rights, Registration of plant varieties under PPV&FR Act 2001, breeders, researcher and farmers rights. Traditional knowledge-meaning and rights of TK holders. Convention on Biological Diversity, International treaty on plant genetic resources for food and agriculture (ITPGRFA). Indian Biological Diversity Act, 2002 and its salient features, access and benefit sharing.

ELECTIVES

11. HORTICULTURE

- a. Course No : HORT(E)-312
- b. Course title : Hi-Tech Horticulture
- c. Credit hour : 3(2+1)
- d. Class : 3rd year B.Sc. (Hons.) Agril.
- e. Semester : 1st Semester

SYLLABUS

Theory

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

Practical

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

12. SOIL SCIENCE & AGRICULTURAL CHEMISTRY

- a. Course No : AC(E)-312
- b. Course title : Biopesticides & Biofertilizers
- c. Credit hour : 3(2+1)
- d. Class : 3rd year B.Sc. (Hons.) Agril.
- e. Semester : 1st Semester

SYLLABUS

Theory

History and concept of biopesticides. Importance, scope and potential of biopesticide. Definitions, concepts and classification of biopesticides viz. pathogen, botanical pesticides, and biorationales. Botanicals and their uses. Mass production technology of bio-pesticides. Virulence, pathogenicity and symptoms of entomopathogenic pathogens and nematodes. Methods of application of biopesticides. Methods of quality control and Techniques of biopesticides. Impediments and limitation in production and use of biopesticide. Biofertilizers - Introduction, status and scope. Structure and characteristic features of bacterial biofertilizers- *Azospirillum*, *Azotobacter*, *Bacillus*, *Pseudomonas*, *Rhizobium* and *Frankia*; Cynobacterial biofertilizers- *Anabaena*, *Nostoc*, *Hapalosiphon* and fungal biofertilizers- AM mycorrhiza and ectomycorrhiza. Nitrogen fixation -Free living and symbiotic nitrogen fixation. Mechanism of phosphate solubilization and phosphate mobilization, K solubilization. Production technology: Strain selection, sterilization, growth and fermentation, mass production of carrier based and liquid biofertilizers. 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

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

13. AGRONOMY

- a. Course No : AG(E)-312
- b. Course title : Weed Management Credit hours
- c. Credit hour : 3(2+1)
- d. Class : 3rd year B.Sc. (Hons.) Agril.
- e. Semester : 1st Semester

SYLLABUS

Theory

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

14. AGRICULTURAL BIOTECHNOLOGY

- | | |
|-----------------|---|
| a. Course No | : ABT(E)-311 |
| b. Course title | : Micro propagation Technologies |
| c. Credit hour | : 3(1+2) |
| d. Class | : 3 rd year B.Sc. (Hons.) Agril. |
| e. Semester | : 1 st Semester |

SYLLABUS

Theory

Setting up of commercial micro propagation unit - Lab and hardening unit design, Equipment, lab wares and consumables, Energy requirement and use of alternate energy sources. Man power requirement, Biosafety measures and waste disposal, Legislative requirement and govt. incentive. Major techniques in micro propagation- Axillary enhancement, Automated somatic embryogenesis systems, Synthetic seeds, Hardening procedures, Sterilization procedure and clean air environment, Risk factor analysis, Handling of contamination, Packaging and transportation, Marketing and Supply chain management, Economics of micropropagation, Material procurement, Stores handling, Cost reduction during production and hardening. GMP and HACCP requirement. Visit to commercial production units and case studies.

Practical

Lab and hardening unit design. Familiarity with equipments, lab wares and consumables. Procedures of autoclaving, Media preparation Explant preparation, Surface sterilization, Axillary bud, nodal explant culture, experiments to induce somatic embryos. Preparation of synthetic seeds, Experiments for hardening of in vitro explants. Visit to commercial Production units and case studies.

SYLLABUS AND COURSE BREAKUP

VIth Semester, 3rd Year B.Sc.(Hons.) Agriculture

01. AGRONOMY

p. Course No	: AG-328
q. Course title	: Rainfed Agriculture and Watershed Management
r. Credit hour	: 2(1+1)
s. Class	: 3 rd year B.Sc. (Hons.) Agril.
t. Semester	: 2 nd Semester

SYLLABUS

Theory

Rainfed agriculture: Introduction, types, History of rainfed agriculture & watershed in India; Problems and prospects of rainfed agriculture in India ; Soil and climatic conditions prevalent in rainfed areas; Drought: types, effect of water deficit on physio- morphological characteristics of the plants, Mechanism of crop adaptation under moisture deficit condition; Water harvesting: importance, its techniques, 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 dry land areas in the country and demarcation of dry land area on map of India. Interpretation of meteorological data and scheduling of supplemental irrigation on the basis of evapo-transpiration demand of crops. Critical analysis of rainfall and possible drought period in the country, effective rainfall and its calculation. Studies on cultural practices viz; mulching, plant density, depth of sowing, thinning and leaf removal for mitigating moisture stress. Characterization and delineation of model watershed. Field demonstration on soil & moisture conservation measures. Field demonstration on construction of water harvesting structures. Visit to rainfed research station/watershed.

02. HORTICULTURE

a. Course No	: ASCE(Ag)-321
b. Course title	: Protected Cultivation and Secondary Agriculture
c. Credit hour	: 2(1+1)
d. Class	: 3 rd year B.Sc. (Hons.) Agril.
e. Semester	: 2 nd Semester

SYLLABUS

Theory

Green house technology: Introduction, Types of Green Houses; Climate control in green house, Planning and design of green houses, 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 Naturally ventilated solar

green house, High tech green house, Use of green house in drying. Concept and construction of low tunnels. Use of shade net house in protected cultivation.

Important engineering properties such as physical, thermal dynamic aero & hydrodynamic of cereals, pulses and oil seed. Concepts of cleaning and grading. Drying and dehydration: Moisture measurement, EMC, Drying theory, Various drying methods, Commercial grain dryers (bin dryer, tray dryer, fluidized bed dryer, re-circulatory dryer and solar dryer). Material handling equipment: Conveyer and elevators, their principle, Working and selection.

Practical

Study of different types of green houses based on shape. Measurement of solar radiation, CO₂ level, humidity and temperature inside and outside green house. 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 grain by oven drying method. Study of spiral, centrifugal and disc separator. Determination of moisture content of various grains by moisture meter. Field visit to seed processing plant and agro processing

03. PLANT PROTECTION:

- a. Course No : PPT-324
- b. Course title : Diseases of Field and Horticultural Crops and their management-II
- c. Credit hour : 3(2+1)
- d. Class : 3rd year B.Sc. (Hons.) Agril.
- e. Semester : 2nd Semester

SYLLABUS

Theory

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

Field crops: Rice: Blast, brown spot, bacterial blight, sheath blight, khaira and tungro. Maize: Stalk rots, leaf blights and downy mildews. Sorghum: Grain smut and anthracnose. Bajra: Downy mildew and ergot. Groundnut: Tikka, collar rot and peanut clump virus. Soybean: Rhizoctonia blight and bacterial pustule. Pigeon pea: Sterility mosaic. Moong, urd and moth beans: Web blight and yellow mosaic. Castor: Phytophthora blight and bacterial blight. Guar: Bacterial blight and Alternaria blight. Sesamum: Stem & root rot and phyllody. Cotton: Wilt, root rot, bacterial blight and leaf curl.

Horticultural crops: Guava: Wilt and zinc deficiency. Banana: Panama wilt, Sigatoka and bunchy top. Papaya: Foot rot, leaf curl, ring spot and root knot. Pomegranate: leaf spots and Bacterial blight. Date palm: Graphiola leaf spot. Coconut: Root rot, wilt, cadang cadang and bud rot. Tea: Blister blight and red rust. Coffee: Rust. Cucurbits: Powdery mildew, mosaic, Choanephora rot and root knot. Brinjal: Phomopsis blight and little leaf. Tomato: Damping off, bacterial wilt, early blight, leaf curl and root knot. Okra: Yellow vein mosaic. Ginger: Rhizome rot.

Practical

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

Maize: leaf blights and downy mildews. Sorghum: Grain smut and anthracnose. Bajra: Downy mildew and ergot. Groundnut: Tikka, collar rot and peanut clump virus. Pigeon pea: Sterility mosaic. Moong, urd and moth beans: Web blight and yellow mosaic. Castor: Bacterial blight. Guar: Bacterial blight and Alternaria blight. Sesamum: Phyllody. Cotton: Wilt, root rot, bacterial blight and leaf curl. Guava: zinc deficiency. Papaya: Leaf curl. Pomegranate: leaf spots and Bacterial blight. Cucurbits: Powdery mildew, mosaic, Choanephora rot and root knot. Brinjal: Little leaf. Tomato: Damping off, early blight, leaf curl and root knot. Okra. Yellow vein mosaic. Date palm: Graphiola leaf spot.

Note: Students should submit 20 pressed and well-mounted specimens.

04. HORTICULTURE

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|-----------------------|---|
| a. Course No | : HORT-325 |
| b. Course title | : Post-harvest management and value addition of fruit and vegetable |
| c. Credit hour | : 2(1+1) |
| d. Class | : 3 rd year B.Sc. (Hons.) Agril. |
| e. Semester | : 2 nd Semester |
| f. General objective | : |
| g. Specific objective | : |

SYLLABUS

Theory

Importance of fruits and vegetables, extent and possible causes of post harvest losses; Pre-harvest factors affecting postharvest quality, maturity, ripening and changes occurring during ripening; Respiration and factors affecting respiration rate; Role of ethylene; Post harvest disease and disorders; Heat, chilling 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.

05. AGRICULTURE ENTOMOLOGY

- | | |
|-----------------|---|
| a. Course No | : ENT-323 |
| b. Course title | : Management of Beneficial Insects |
| c. Credit hour | : 2(1+1) |
| d. Class | : 3 rd year B.Sc. (Hons.) Agril. |
| e. Semester | : 2 nd Semester |

SYLLABUS

Theory

Importance of beneficial insects. History of bee keeping; Types of honey bees, bee biology and caste system. Bee pasturage and floral calendar. Commercial methods of bee keeping; bee equipments; seasonal management. Bee foraging and communication behaviour. Insect pests and diseases of honey bees and their management. Insecticidal poisoning in honey bees. Effect of bee pollination in enhancing crop yield.

Types of silkworms (Mulberry and non-mulberry), voltinism and biology of silkworms. Mulberry cultivation, mulberry varieties, methods of harvesting and preservation of leaves. Rearing, mounting and harvesting of cocoons. Rearing appliances of mulberry silkworm and methods of disinfection. Pest and diseases of silkworm and their management. Species of lac insect, morphology, biology, host plants. Lac production – seed lac, button lac, shellac, lac products. Natural enemies of lac insect and their management. Important species of pollinators, weed killers, scavengers, insects as food and other insects of economic importance.

Practical

Acquaintance with honey bee species and different castes of bees. Beekeeping appliances. Seasonal management. Identification of bee enemies and diseases. Identification of bee foraging plants. Acquaintance with silkworm species and their rearing. Mulberry cultivation, mulberry varieties, methods of harvesting and preservation of leaves. Identification of lac insect. Collection and identification of other important pollinators, weed killers and scavengers. Visit to research and training institutions devoted to beekeeping, sericulture, lac culture and natural enemies.

06. PLANT BREEDING & GENETICS

- a. Course No : PBG-325
- b. Course title : Crop Improvement – II (*Rabi*)
- c. Credit hour : 2(1+1)
- d. Class : 3rd year B.Sc. (Hons.) Agril.
- e. Semester : 2nd Semester

SYLLABUS

Theory

Centers of origin, distribution of species, wild relatives in different cereals; pulses; oilseeds; fodder crops and cash crops; vegetable and horticultural crops; Plant genetic resources, its utilization and conservation; Floral biology, study of genetics of qualitative and quantitative characters; Important concepts of breeding self pollinated, cross pollinated and vegetatively propagated crops; Major breeding objectives and procedures including conventional and modern innovative approaches for development of hybrids and varieties for yield, adaptability, stability, abiotic and biotic stress tolerance and quality (physical, chemical, nutritional); Seed production technology in self pollinated, cross pollinated and vegetatively propagated crops.

Cereals: Wheat, oats and barley

Pulses: Chickpea, lentil and field pea

Oilseeds: Rapeseed mustard and sunflower

Fodder: Berseem, oats and lucerne

Cash crop: Sugarcane

Seed spices and medicinal plants: Cumin, coriander, fenugreek, fennel and isabgol

Vegetables & Hort. crops: Potato

Hybrid seed production technology of rabi crops. Ideotype concept and climate resilient crop varieties for future.

Practical

Emasculation and hybridization techniques in different crop species namely Wheat, Oat, Barley, Chickpea, Lentil, Field pea, Rapeseed Mustard, Sunflower, Potato, Berseem. Sugarcane; 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.

07. AGRONOMY

Credit hours: 2(0+2)

- a. Course No : CP-322
- b. Course title : Practical Crop Production-II (Rabi Crops)
- c. Credit hour : 2(0+2)
- d. Class : 3rd year B.Sc. (Hons.) Agril.
- e. Semester : 2nd Semester

SYLLABUS

Practical

Crop planning, raising field crops in multiple cropping systems: Field preparation, seed, treatment, nursery raising, sowing, nutrient, water and weed management and management of insect-pests diseases of crops, harvesting, threshing, drying winnowing, storage and marketing of produce.

The emphasis will be given to seed production, mechanization, resource conservation and integrated nutrient, insect-pest and disease management technologies. Preparation of balance sheet including cost of cultivation, net returns per student as well as per team of 8-10 students.

08. AGRONOMY

- a. Course No : AG-329
- b. Course title : Principles of Organic Farming
- c. Credit hour : 2(1+1)
- d. Class : 3rd year B.Sc. (Hons.) Agril.
- e. Semester : 2nd Semester

SYLLABUS

Theory

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

farming; Processing, leveling, economic considerations and viability, marketing and export potential of organic products.

Practical

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

COURSE BREAKUP

(A) Theory lecture outline

Lecture No	Topic
01	Organic farming, principles and its scope in India, problems and prospects
02	Initiatives taken by Government (central/state), NGOs and other organizations for promotion of organic agriculture
03	Organic ecosystem and their concepts
04	Organic nutrient resources and its fortification
05	Use of FYM, compost and vermicompost in organic farming
06	Use of oilcakes, green manures and bio fertilizers in organic farming
07	Choice of crops and varieties in organic farming
08	Fundamentals of insect, pest, disease management under organic mode of production(Pheromone trap, light trap, sticky trap, Bt, NPV, predators and parasites)
09	Fundamentals of weed management under organic mode of production
10	Indigenous Technical Knowledge(ITKs) in organic farming
11	Niche areas and commodities for organic farming, crops with potentiality for organic farming
12	Operational structure of NPOP
13	Certification process and standards of organic farming
14	Processing, leveling, logo
15	Economic considerations and viability
16	Marketing and export potential of Indian organic products

(B) Practical class outline

Class No.	Exercise
01	Visit of organic farms to study the various components and their utilization
02	Preparation of enriched compost
03	Preparation of vermicompost
04	Preparation of bio-fertilizers/bio-inoculants and their quality analysis
	Visit to nearby organizations linked with organic farming
05	Indigenous technical knowledge (ITK) for nutrient management
06	Indigenous technical knowledge (ITK) for insect pest management
07	Indigenous technical knowledge (ITK) for disease management
08	Indigenous technical knowledge (ITK) for weed management
09	Seed treatment for organic crop production(rice/pulses/oilseeds/any other field crops)
10	Nutrient management for organic crop production(rice/pulses/oilseeds/any other

Class No.	Exercise
	field crops)
11	Weed management for organic crop production(rice/pulses/oilseeds/any other field crops)
12	Insect pest management for organic crop production(rice/pulses/oilseeds/any other field crops)
13	Disease for organic crop production(rice/pulses/oilseeds/any other field crops)
14	Visit to laboratories linked with production of bio-fertilisers and bio-pesticides
15	Cost of organic production system
16	Post harvest management; Quality aspect, grading, packaging and handling

Reference books:

- Principles of Organic farming - S. R. Reddy
- A handbook of Organic farming - A. K. Sharma
- Handbook of Organic farming and biofertilizers – A. C. Gaur
- Organic farming: Theory and Practice – S. P. Pallaniappa and K. Amadurai
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09. AGRICULTURE EXTENSION EDUCATION

- a. Course No : EE-325
- b. Course title : Entrepreneurship Development & Business Communication
- c. Credit hour : 2(1+1)
- d. Class : 3rd year B.Sc. (Hons.) Agril.
- e. Semester : 2nd Semester

SYLLABUS

Theory

Concept of Entrepreneur, Entrepreneurship Development, Characteristics of entrepreneurs; SWOT Analysis & achievement motivation, Entrepreneurial behavior, Government policy and programs and institutions for entrepreneurship development, impact of economic reforms on agri-business/Agri-enterprises, Entrepreneurial Development Process; Developing organizational skill (controlling, supervising, problem solving, monitoring & evaluation), Developing Managerial skills, Business Leadership Skills (communication, direction & motivation skills); Problem solving skill; Supply chain management and Total quality management, Project Planning Formulation and Report preparation; Financing of Enterprise, Opportunities for agri-entrepreneurship and rural enterprise.

Practical

Assessing entrepreneurial traits, problem solving skills, managerial skills and achievement motivation, exercise in creativity, time audit through planning, monitoring & supervision, identification and selection of business idea, preparation of business plan and proposal writing, visit to entrepreneurship development institute and entrepreneurs.

10. HORTICULTURE

- a. Course No : FSN (Ag)-321
- b. Course title : Principles of Food Science and Nutrition

- c. Credit hour : 2(2+0)
- d. Class : 3rd year B.Sc. (Hons.) Agril.
- e. Semester : 2nd Semester

SYLLABUS

Theory

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

ELECTIVES

11. HORTICULTURE

- a. Course No : HORT(E)-323
- b. Course title : Protected cultivation
- c. Credit hour : 3(2+1)
- d. Class : 3rd year B.Sc. (Hons.) Agril.
- e. Semester : 2nd Semester

SYLLABUS

Theory

Protected cultivation- importance and scope, Status of protected cultivation in India and World types of protected structure based on site and climate. Cladding material involved in greenhouse/ poly house. Greenhouse design, environment control, artificial lights, Automation. Soil preparation and management, Substrate management. Types of benches and containers. Irrigation and fertigation management. Propagation and production of quality planting material of horticultural crops. Greenhouse cultivation of important horticultural crops – rose, carnation, chrysanthemum, gerbera, orchid, anthurium, liliun, tulip, tomato, bell pepper, cucumber, strawberry, pot plants, etc. Cultivation of economically important medicinal and aromatic plants. Off-season production of flowers and vegetables. Insect pest and disease management.

Practical

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

12. SOIL SCIENCE & AGRICULTURAL CHEMISTRY

- a. Course No : AC(E)-323
- b. Course title : Soil, Plant, Water and Seed testing
- c. Credit hour : 3(2+1)

- d. Class : 3rd year B.Sc. (Hons.) Agril.
 e. Semester : 2nd Semester
 f.

SYLLABUS

Theory:

Principle of pH meter, EC meter, spectrophotometer, flame photometer and AAS. Soil analysis: Objectives, sampling of soil, procedure and precautions. Determination of texture, bulk density. Interpretation of analytical data viz., pH, EC, organic carbon, N, P, K, S and micronutrients (Fe, Mn, Zn, Cu, B) and nutrient index. Plant analysis: Sampling stages and plant part to be sampled. Analysis of nutrients, Quantitative rating of plant analysis data and interpretation of results, critical nutrient concentration, critical nutrient ranges. Water analysis: Quality criteria, classification and suitability of irrigation water and water quality index. Seed: Introduction, definition and importance, seed germination, viability, vigor and storage. Use of soil testing kit for major and micronutrient analyzer.

Practical

Standardization of solutions and reagents, collection and preparation of soil samples, estimation of pH, EC, organic carbon, NPKS, micronutrients, CEC and exchangeable sodium in soil. Determination of EC and pH of saturation extract/paste. Estimation of cations and anions. Plant sampling and sample preparation for analysis, digestion of plant material and estimation of N, P, K in plant. Rapid plant tissue test for N, P, and K. Determination of EC, pH, cations (Ca^{++} , Mg^{++} , Na^+ , K^+) and anions (B , CO_3^- , HCO_3^- , Cl^-) in irrigation water. Computation of SAR and RSC. Seed quality testing: Germination, viability, moisture and vigor.

13. AGRONOMY

- a. Course No : AG (E)-323
 b. Course title : Agricultural Waste Management
 c. Credit hour : 3(2+1)
 d. Class : 3rd year B.Sc. (Hons.) Agril.
 e. Semester : 2nd Semester

SYLLABUS

Theory

Introduction to agricultural waste management, Nature and characteristics of agricultural waste and their impact on the environment, Kinds of wastes, Classification, role of soil and plants in waste management, sources of waste, impact of waste on soil and plant quality, Biological processes of waste management, Utilization and Recycling of Agricultural waste, Potential of Recyclable Crop Residues and its management, In-situ management of agriculture waste, Composting and Vermicomposting for bio conservation of biodegradable waste, Biogas Technology, Agricultural waste and water, air and animal resources, Impacts of waste on human, animal health and environment. Management of bedding & litter, wasted feed, run-off from feed lots and holding areas and waste water from dairy parlors, agro-waste recycling through farming system, waste management machineries, environmental benefit of waste management.

Practical

Collection and preparation agricultural waste sample. Determination of pH, EC, CE_{Ce}, heavy metals, BOD, COD, TSS, TDS, NH₄, Total P, and dissolved reactive P. Nutrient status (N, P, K, secondary and micronutrients) analysis of agricultural waste. Waste management equipment operation, Maintenance and safety hazards, computer software and models. Survey of different agri waste from live stock, dairy, poultry, food processing, fruit & vegetable and agri-chemicals, Preparation of compost, Vermicomposting, biogas and analysis of compost.

14. AGRICULTURAL ECONOMICS

- a. Course No : AE(E)-321
- b. Course title : Agri-Business Management
- c. Credit hour : 3(2+1)
- d. Class : 3rd year B.Sc. (Hons.) Agril.
- e. Semester : 2nd Semester

SYLLABUS

Objective

The Objective of the course is to develop an understanding of the field of Agribusiness management and to familiarize the students with the management of Agro-based industries .

Theory

Transformation of agriculture into agribusiness , various stakeholders and components of agribusiness system. Importance of agribusiness in the Indian economy and New Agricultural Policy. Distinctive features of Agribusiness Management : Importance and needs of agro-based industries, Classification of industries and types of agro based industries. Institutional arrangement, procedures to set up agro based industries. Constraints in establishing agro-based industries. Agri-value chain: Understanding primary and support activities and their linkages. Business environment : PEST & SWOT analysis. Management functions: Roles & activities, Organization culture. Planning, meaning, definition, types of plans. Purpose or mission, goals or objectives, Strategies, policies procedures, rules, programs and budget. Components of a business plan, steps in planning and implementation. Organization staffing, directing and motivation. Ordering, leading, supervision, communications, control. Capital Management and Financial Management of Agribusiness. Financial statements and their importance. Marketing management: Segmentation, targeting and positioning. Marketing mix and marketing strategies. Consumer behavior analysis, product life cycle (PLC). Sales and 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: grain, fruits, vegetables, flowers. Study of product markets, retails trade commodity trading and value added products. Study of financing institutions-co-operative, 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.
