Syllabus:

B. Voc. In Sustainable Agriculture (BVSA)

Ramakrishna Mission Vivekananda Educational and Research Institute (RKMVERI)
Faculty of Agriculture Rural and Tribal Development (ARTD)
Morabadi, Ranchi, Jharkhand 834008

Course Code Prefixes-

BVGE- General Education
BVSA- Skill Component
BVEC- Elective Course
BVIAP- Industrial Attachment/ Apprenticeship
BVRC- Research Component

Semester-I

Course Code	Course Component	Course Title	Credit (L+T+P)	Cumulative Credit
BVGE-101	General Education	Extension Education-I	1+0+1	**8**
BVGE-102		Value Education-I	1+0+0	
BVGE-103		Communicative English and Basic Computer Application	1+0+4	
BVSA-101	Skill Component	Fundamentals of Agronomy	2+0+2	**12**
BVSA-102		Livestock Production and Management	2+0+2	
BVSA-103		Basic Crop Protection Technology	2+0+2	
		Total credit in Semester-I	**9+11=20**	**20**

Semester-II

Course Code	Course Component	Course Title	Credit (L+T+P)	Cumulative Credit
BVGE-201	General Education	Environmental Science	3+0+1	**16**
BVGE-202		Value Education-II	1+0+1	
BVGE-203		Professional Skills Development	1+0+1	
BVSA-201	Skill Component	Basic Organic Horticulture	2+0+2	**24**
BVSA-202		Basic Organic and Natural Farming	2+0+2	
BVSA-203		Integrated Pest and Disease Management	2+0+2	
		Total credit in Semester-II	**11+0+9=20**	**40**
BVIAP-201		Industrial Attachment*	0+0+4	**44**

*** For Exit Level Students only**

Semester-III

Course Code	Course Component	Course Title	Credit (L+T+P)	Cumulative Credit
BVGE-301	General Education	Extension Education-II	1+0+1	**24**
BVGE-302		Practice of Yoga	1+0+1	
BVGE-303		Agro-based Biotechnology	2+0+2	
BVSA-301	Skill Component	Fundamentals of Soil and Water Conservation	2+0+2	**36**
BVSA-302		Applied Horticulture	2+0+2	
BVSA-303		Crop Production Technology	2+0+2	
		Total credit in Semester-III	**10+0+10=20**	**20/60**

Semester-IV

Course Code	Course Component	Course Title	Credit (L+T+P)	Cumulative Credit
BVGE-401	General Education	Entrepreneurship Development	2+0+1	**32**
BVGE-402		Value Education-IV	1+0+1	
BVGE-403		Agri-marketing and Cooperatives	2+0+1	
BVSA-401	Skill Component	Secondary Agriculture	2+0+2	**48**
BVSA-402		Advanced Organic Horticulture	2+0+2	
BVSA-403		Crop Cafeteria and Gardening	0+0+4	
		Total credit in Semester-IV	**9+11=20**	**80**
BVIAP-401		Industrial Attachment*	0+0+4	**84**

*** For Exit Level Students only**

Semester-V

Course Code	Course Component	Course Title	Credit (L+T+P)	Cumulative Credit
BVGE-501	General Education	Scientific Communication Skills and Integral Personality Development	1+0+1	**42**
BVGE-502		Post-Harvest Management and Value Addition	2+0+2	
BVGE-503		Agri-Business Management	2+0+2	
BVSA-501	Skill Component	Advanced Organic and Natural Farming	2+0+2	**58**
BVSA-502		Experiential Learning Programme (ELP)	0+0+6	
		Total credit in Semester-V	**7+0+13=20**	**100**

Semester-VI

Course Code	Course Component	Course Title	Credit (L+T+P)	Cumulative Credit
BVSA-601	Skill Component	Farm Machinery and Power	2+0+2	**78**
BVSA-602		Seed Production Technology	2+0+2	
BVEC-601		Innovative Project	0+0+2	
BVEC-602		Students Social Responsibilities (SSR)	0+0+2	
BVIAP-601		Industrial Attachment	0+0+10	
		Total credit in Semester-VI	**4+0+16=20**	**120**

Elective Courses- BVEC-601 or BVEC-602

Semester-VII

Course Code	Course Component	Course Title	Credit (L+T+P)	Cumulative Credit
BVGE-701	General Education	Elementary Statistics	1+0+1	**52**
BVGE-702		Human Resource Management	2+0+2	
BVGE-703		Transfer of Technology	0+0+4	
BVSA-701	Skill Component	Basic Accounting and Book-keeping	2+0+2	**88**
BVSA-702		ICT in Agriculture and MIS	1+0+1	
BVSA-703		Rural Living and Learning Experiences (RLLE)	0+0+4	
		Total credit in Semester VII	**6+0+14=20**	**140**

Semester-VIII with research

Course Code	Course Component	Course Title	Credit (L+T+P)	Cumulative Credit
BVRC-801	General Education	Research Methodology	2+0+1	**60**
BVRC-802		Proposed Plan of Research Work (PPRW)	0+0+2	
BVRC-803		Research and Publication Publication Ethics and Review of Literature	2+0+1	
BVRC-804	Skill Component	Agricultural Research-Oriented Project Work	0+0+12	**100**
		Total credit in Semester-VIII	**4+0+16=20**	**160**

Semester-VIII without research

Course Code	Course Component	Course Title	Credit (L+T+P)	Cumulative Credit
BVIAP-801	Industrial Attachment	Apprenticeship	0+0+20	**108**
		Total credit in Semester-VIII	**20**	**160**

Note- Research is optional in the Semester VIII

Semester-I

Course Code	Course Component	Course Title	Credit	Cumulative Credit
BVGE-101	General Education	Extension Education-I	1+0+1	**8**
BVGE-102		Value Education-I	1+0+0	
BVGE-103		Communicative English and Basic Computer Application	1+0+4	
BVSA-101	Skill Component	Fundamentals of Agronomy	2+0+2	**12**
BVSA-102		Livestock Production and Management	2+0+2	
BVSA-103		Basic Crop Protection Technology	2+0+2	
		Total credit in Semester-I	**9+0+11=20**	**20**

Extension Education-I
Course Code- BVGE-101
Credit- 1+0+1 (Lecture+Tutorial+Practical)

Theory **16 hrs**

UNIT-I: Extension education-concept, principles and scope **4 hrs**

Extension Education: Definition and meaning; Concept & Nature of Extension-Education. Objectives, principles and philosophy of Extension Education.

UNIT-II: Adoption and diffusion of innovation **8 hrs**

Adoption and diffusion of innovation: Definition, concept of adoption, diffusion and innovation, stages of adoption process, rate of adoption, adopter categories; elements of adoption and diffusion. Innovation: characteristics, steps involved in introducing an innovation in a community.

UNIT-III: Extension Teaching Methods **6 hrs**

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.

UNIT-IV: New trends in agriculture extension **4 hrs**

Pprivatization extension, cyber extension/ e-extension, market-led extension, farmer-led extension, expert systems, precision farmingetc.

Practical **32 hrs**

1. Visit to NGO and learn from their experience in rural development **8 hrs**
2. Preparation of extension literature – leaflet, booklet, folder, pamphlet news stories and success

stories; Presentation skills exercise; micro-teaching exercise **8 hrs**

3. Exposure visit to village to understand the problems being encountered by the villagers/farmers. **8hrs**
4. Handling and use of audiovisual equipments; preparation and use of A-V aids. **4 hrs**
5. Seminar on the overview of the module at the end of the semester. **8 hrs**

Suggested Readings:

1. *Extension communication and Management – G.L. Ray, Kalyani Publishers.*
2. *Education and communication for development – Dahama & Bhatnagar, Oxford & IBH.*
3. *Fundamentals of Extension Education and Management in Extension/K.A. Jalihal and V. Veerabhadraiah. New Delhi, Concept Pub., 2007*

Value Education-I
Course Code- BVGE-102
Credit- 1+0+0 (Lecture+Tutorial+Practical)

Theory **16 hrs**

Unit-I: Swami Vivekananda and Rural Development **10 hrs**

Swamiji's guidelines on rural development, Swamiji's vision on the developmental activities at Hazaribagh area, and Six great postulates of Swami Vivekananda

Unit-II: Personality Development **4 hrs**

Personality- Definition, personality attributes, Character- Its role in personality development, how to build character? Nourishment of the five levels of personality development.

Unit-III: Utterings for Universal Peace **2 hrs**

Five Shanti mantras: - Chanting, and meaning with explanation.

Bhagavat Geeta- any five shlokas from Bhagavat Geeta

Communicative English and Basic Computer Application
Course Code- BVGE-103
Credit- 1+0+4 (Lecture+Tutorial+Practical)

Theory **16 hrs**

Unit-I: Understanding English Language **10 hrs**

Reading comprehension- scientific and general passages. Vocabulary development; Prefix and Suffix; Synonyms and Antonyms; words often confused. Writing Skills-Mechanics of letter writing-business, official, and personal letters.

Unit-II: Presentation Skills **6 hrs**

Presentation Skills: Features of oral presentation; body language, voice modulation, audience analysis, preparation of visual aids, Evaluation of presentation, practice of presentation using Power Point and LCD projector.

Practical (Computer) **128 hrs**

1. Introduction to Computer & Basic Concepts **10 hrs**

- What is Computer: Characteristics of Computer System, Basic Applications of Computer; Processing Unit, Keyboard, mouse and VDU, Other Input devices, Other Output devices, Computer Memory; ¬
- Concept of Hardware and Software: Hardware, Software, Application Software, Systems software, Programming Languages; Representation of Data/Information; Concept of Data processing.

2. Operating System **15 hrs**

- Basics of Operating System: Operating system, Basics of popular operating system (LINUX, WINDOWS)
- The User Interface: Task Bar, Icons, Start Menu, Running an Application
- Operating System Simple Setting: Changing System Date and Time, Changing Display Properties, Adding or Remove a Windows Component, Changing Mouse Properties, Adding and removing Printers
- File and Directory Management: Types of files, What is a file, Naming conventions, File Extensions, File Pathway, Windows Explorer window, Viewing files, File property dialogue box, Explain file size (bytes, kilo, mega, giga, tera) and abbreviations used, Create a Folder, Move a file (multiple files)into a folder, Delete files and folders, Recovering deleted files, Renaming files, Searching for files, Creating and deleting shortcuts on desktop, How programs may save files in specific location by default. How to find where a file is being saved
- Desktop: exploring the desktop, cleaning the desktop
- Keep Software updated: how to set automatic updates for the windows operating system.

3. Introduction to basics of Data Entry **12 hrs**

- Importance of Data and Job roles associated.
- Advantages of Data Storage
- Comparative analysis between DTP and Data Entry Professional
- Understanding the importance of Data sanctity
- Understanding fundamentals of Hardware and Cloud-based Data Storage
- Overview of File types used for data storing
- Identification of software and applications used for Data Entry.
- Identification with Qwerty Keyboard and entry system.
- Identifying types of Data Entry software available in the market

4. Word Processing **15 hrs**

- Word Processing Basics: Opening Word Processing Package, Menu Bar, Using the Help, Using the Icons Below Menu Bar

- Opening and closing Documents: Opening Documents, Save and Save as, Page Setup, Print Preview, Printing of Documents;
- Text Creation and manipulation: Document Creation, Editing Text, Text Selection, Cut, Copy and Paste, Spell check, Thesaurus;
- Formatting the Text: Font and Size selection, Alignment of Text, Paragraph Indenting, Bullets and Numbering, Changing case
- Formatting a document: Set page margin, paragraphs and sections within a document, adjust indents and hanging indents
- Table Manipulation: Draw Table, changing cell width and height, Alignment of Text in cell, Delete / Insertion of row and column Border and shading, Table Formula
- Inserting Graphic Elements: Insert a clip art picture, insert symbols and special characters, adding a watermark; Using word art; adding a drop cap
- Mail Merge: Using mail merge; printing mailing labels; merging for sending emails using outlook.
- Macros, Use of local language

5. Spread Sheet **15 hrs**

- Elements of Electronic Spread Sheet: Opening of Spread Sheet, Addressing of Cells, Printing of Spread Sheet, Saving Workbooks
- Manipulation of Cells: Entering Text, Numbers and Dates, Creating Text, Number and Date Series, Editing Worksheet Data, Inserting and Deleting Rows, Column, Changing Cell Height and Width
- Formulas and Function: Using Formulas, Function, basic mathematical operators, using AutoSum etc., using formulas with multiple cell references, finding the right function, relative and absolute cell references, fixing formula errors; Charts: learning about charts, creating charts; Working with graphics; Clip Art; SmartArt.

6. Introduction to MS PowerPoint **12 hrs**

- Basic Concepts of presentation: Using PowerPoint, Opening A PowerPoint Presentation, Saving A Presentation
- Creation of Presentation: Creating a Presentation Using a Template, creating a Blank Presentation, Entering and Editing Text, Inserting and Deleting Slides in a Presentation
- Preparation of Slides: Inserting Word Table or An Excel Worksheet, Adding Clip Art Pictures, Inserting Other Objects, Resizing and Scaling an Object
- Presentation of Slides: Viewing A Presentation, Choosing a Set Up for Presentation, Printing Slides and Handouts
- Slide Show: Running a Slide Show, Transition and Slide Timings, Automating a Slide Show.

7. Database Management System **12 hrs**

- Introduction to the concepts of database management system; Creating a database
- Creating a Table: Concepts of field, field types; entering data in a table, preview and print a table, changing row and column height; closing and opening of table, sorting of table, finding and replacing texts; using queries wizard; creating report from tables / queries from report wizard, modifying a report, printing of report; creating a form using wizard, entry in the forms; basic of formatting of forms and reports.

8. Understanding of Data Analysis. **10 hrs**

- Introduction to Data Analysis
- Overview of various tools and functions.

- Working with Data sorting and data filtering
- Using Charts for Data presentation.
- Importance of Data Security

9. PC Maintenance, Security and Troubleshooting 12 hrs

- Computer Maintenance and Security: Overview of Computer Maintenance and Security, Inbuilt PC Security, tools, securing documents, Antivirus, Upgrading Operating System and Application software. security; Cleaning the monitor, keyboard, CPU
- Deleting unnecessary programs and files: Disk cleanup, deleting toolbars; defrag hard drive
- Computer Maintenance Programs: Ccleaner, my Defrag, Spinrite etc.
- Basic troubleshooting: restart computer, checking cables, uninstalling a software, start windows in safe mode etc.

10. Soft Skill (Computer and English) 15 hrs

- Effective communication: features of effective communication
- Communication Skills & Call Handling Skills
- Listening skills: Types of Listening; Tips for Effective/ Listening: Academic Listening-(lecturing), Listening to talks and Presentations, Listening to Announcements.
- Corporate culture
- Behavioural Skills
- Vocabulary Development
- Pronunciation
- Reading, writing, listening and speaking

Fundamentals of Agronomy
Course Code- BVSA-101
Credit- 2+0+2 (Lecture+Tutorial+Practical)

Objectives:

The paper familiarizes the students with the -

a) Basics of agricultural sciences.

b) Identification and classification of seeds, crops, weeds, tillage implements, sowing methods, and manures & fertilizers.

c) Concepts of nutrient management, water management, weed management, harvesting, and post-harvest operations.

Theory 32hrs

Unit-I: Introduction to Agriculture 4 hrs

Introduction to agriculture and agronomy, History and scope of agriculture, Classification of agronomic crops

Unit-II: Tillage and Sowing 6 hrs

Definition of tillage, Objectives, Types, Factors affecting tillage; Modern concept of tillage – Minimum Tillage, Zero Tillage, Puddling, etc. Definition of seed, Seed germination, Seed

treatment methods, Seed Rate and Spacing, Methods of Sowing, Time of Sowing, Depth of Sowing

Unit-III: Nutrient Management **6 hrs**

Crop nutrition, Classification of essential elements, Manures, Fertilizers, Biofertilizers and green manuring, Time and Methods of manure and fertilizer application

Unit-IV: Water Management **6 hrs**

Soil-plant-water relationship, crop water requirement, irrigation- scheduling criteria and methods.

Unit-V: Weed Management **6 hrs**

Definition of weeds, Beneficial and harmful effects of weeds, Crop-Weed competition, Concepts and Methods of weed management; Integrated Weed Management

Unit-VI: Harvesting and Threshing of Crops **4 hrs**

Harvesting, Threshing, Winnowing, Drying & Storage of crops.

Practical: **64 hrs**

1. Identification of agronomic crop seeds.
2. Identification of agronomic crops and their growth stages
3. Study of agro-climatic zones of India and Jharkhand.
4. Identification of different hand tools, primary tillage implements, secondary tillage implements and implements for intercultivation & weeding.
5. Identification of weeds
6. Numerical exercises on manure and fertilizers
7. Numerical exercises on seed rate
8. Numerical exercises on herbicide spray and weed control efficiency
9. Preparation of seed album
10. Preparation of herbarium on weeds
11. Preparation of crop calendar
12. Methods for manure and fertilizer applications
13. Methods for herbicide application
14. Identification and study of green manures, manures and fertilizers
15. Study of various irrigation devices
16. Visit to organic farms.

Suggested Readings:

1. Balasubrananiyan P & Palaniappan SP. Principles and Practices of Agronomy. Agrobios.
2. Chandrasekaran B, Annadural K &Samasundaram E. A Text Book of Agronomy. New Age International (P) Limited Publishers.
3. Das DK. Introductory Soil Science. Third Revised Edition, Kalyani Publishers.
4. Reddy SR. Principles of Agronomy. Kalyani Publishers.
5. Reddy T.Y. & Reddi G.H.S. Principles of Agronomy. Kalyani Publishers.
6. Handbook of Agriculture, ICAR Publication.

Livestock Production and Management
Course Code- BVSA-102
Credit- 2+0+2 (Lecture+Tutorial+Practical)

Objectives:

The paper familiarizes the students on the -

- **a.** Demonstrates technical skills relating to the scientific and dimensions of animal system;
- **b.** Perform technical skills related to livestock;
- **c.** Determine digestive nutritional requirements of ruminant and non-ruminant animals;
- **d.** Identify animal pest and diseases;
- **e.** Calculate and records the cost of keeping a livestock project.

Theory **32 hrs**

Unit – 1: Care & Management of Livestock and Poultry **12 hrs**

Significance of livestock and poultry in Indian economy; Role of livestock and poultry in Indian agriculture; Important Indigenous and exotic breeds of livestock and poultry; Improvement of farm animals and poultry; Different Rearing System in poultry farming. Housing management – Farm site selection, Principles, Space requirement for different species of livestock and poultry; Care and management of calves, heifers, pregnant, lactating animals and work bullocks; Clean milk production, Methods of milking – hand and machine milking; Incubation, hatching and brooding; Care and management of chicks, broilers & layers; Marketing channels in poultry – Market information, Client relationship,

Unit – 2: Nutrition of Livestock and Poultry **8 hrs**

Digestive system in livestock and poultry; Classification of feedstuffs; Feed ingredients for ration for livestock and poultry; Feed supplements and feed additives. Feeding of livestock and poultry; Requirement and importance of green fodder, carrying capacity, and forage cycle; Hay & Silage making.

Unit – 3: Diseases of Livestock and Poultry **12 hrs**

Important diseases of livestock (Foot & Mouth disease, Anthrax, Black Quarter, Haemorrhagic septicaemia, Milk fever, Mastitis, Tympanites, PPR, Swine fever, Diarrhoea, etc.) and Poultry [Viral-Ranikhet (NCD), IBD, Fowl Pox, Bird Flu), Bacterial-BWD, Cholera, Infectious corrhiza, CRD, E.coli) & Protozoan- Coccidiosis, and metabolic and nutritional deficiencies diseases.

Practical: **64 hrs**

1. Identification methods of farm animals and poultry.
2. Visit to dairy and poultry farm to study breeds of livestock and poultry and daily routine farm operations and farm records.
3. Judging and Culling of livestock and poultry.
4. Computation and Formulation of rations and concentrate mixtures for livestock and poultry.
5. Clean milk production and milking methods. Procedure of right milking technique.
6. Hatchery operations, incubation and identification of hatching equipments.

7. Management of chicks, growers and layers.
8. Debeaking, dusting, vaccination, practice of general safety, first-aid and use of disinfectants.
9. Economics of cattle, buffalo, sheep, goat, swine and poultry production.
10. Procedure of biogas production.
11. Collection and handling of eggs.
12. Identification and harvesting of birds for meat purpose.
13. Different bio-security measures in livestock and Poultry Farm.
14. Documentation of records for layers and broilers production (relate to small poultry farm).

Suggested Readings:

i. Banerjee GC. 1989. *Text Book of Animal Husbandry.* Oxford and IBH.
ii. ICAR. 1962. *Handbook of Animal Husbandry*. ICAR Publication.
iii. Parsad Jagdish. 2001. *Poultry Production and Management.* Kalyani Publishers.
iv. Sastry NSR & Thomas CK. 1991. *Dairy Bovine Production.* Kalyani Publishers.
v. Singh RA. 1990. *Poultry Production.* Kalyani Publishers.
vi. Thomas CK & Sastry NSR. 2013. *Livestock Production Management.* Kalyani Publishers.

Basic Crop Protection Technology
Course Code- BVSA-103
Credit- 2+0+2 (Lecture+Tutorial+Practical)

Theory **32hrs**

Unit I: Entomology and Insect **4 hrs**

- Definition, importance, and history of Entomology
- Characteristics of insect
- Agriculturally important insect orders and their characteristics
- Economic importance of insects

Unit-II: Pest and Damage **4 hrs**

- Definition and Categories of pests
- Different types of damage caused by insect pests
- Surveillance of insect pest
- Concept of injury level

Unit-III: Integrated Pest Management **7 hrs**

- Integrated Pest Management: definition, concept, objectives and prerequisites
- Methods of pest management: cultural, mechanical, physical, biological, chemical,
- legal and host plant resistance
- Integrated Pest Management strategies for major groups of insect pests like chewing pests, sucking pests, underground feeders etc.

Unit-IV: Mass production of bioagents **2 hrs**

- Mass production of bioagents like *Trichogramma spp*. and *Bracon spp.*

Unit-V: Basic Concept of Plant Pathology **4 hrs**

- Definition, scope and objectives of Plant Pathology
- Terms and concepts in Plant Pathology

- Classification of Plant disease and Factors affecting disease development
- Disease triangle and tetrahedron

Unit-VI: Plant Pathogens and Bio control Agents **4 hrs**

- Important plant pathogenic organisms and diseases caused by them
- Biocontrol agents and their uses in Agriculture

Unit-VII: Plant Protecting chemicals and organics **7 hrs**

- Organic Fungicides, Fungicides and antibiotics
- Principles of Plant Disease Management

Practical **64 hrs**

1. Collection and identification of different insects
2. Collection and identification of various symptoms of damage caused to crops by pests
3. Surveillance of insect pests by using different traps like light trap, pheromone trap and sticky trap
4. Application of different cultural, mechanical and physical practices for management of pests
5. Field release of bio-agents like *Trichogramma spp., Bracon spp. etc* for pest management
6. Pesticide formulation: types and use
7. Plant protection appliances: identification, their parts and use
8. Calculation of required doses of pesticides, preparation of spray solution and safe use of pesticide
9. Preparation and application of botanical pesticides
10. Application of microbial pesticides
11. Mass production of bioagents
12. Lab visit and acquaintance with different laboratory equipment.
13. Field visit and plant disease diagnosis.
14. Collection, Isolation, Purification, and Preservation of plant pathogens.
15. Symptoms of various plant diseases caused by Biotic and Abiotic agents.
16. Application of Biocontrol agents, Botanicals, and Fungicides.
17. Seed treatment with Biocontrol agents, Botanicals and Fungicides.
18. Preparation of non-chemicals and botanicals against disease management
19. Application of non-chemicals and botanicals on the crop.

i. ***Suggested Readings:***

ii. *Insecta: K. N. Ragumoorthi, V. Balasubramani, M.. R. Srinivasan and N. Natarajan*
iii. *Elements of Economic Entomology- B. Vasanthraj David and V. V. Ramamurthy*
iv. *Integrated pest management- G.S. Dhaliwal and Ramesh Arora*
v. *Textbook of Applied Entomology (Vol. I)- K.P. Srivastava and G.S. Dhaliwal Applied Entomology- D.S. Reddy*
vi. *A textbook of Fungi, Bacteria and Viruses: H.C.Dube*

Semester-II

Course Code	Course Component	Course Title	Credit	Cumulative Credit
BVGE-201	General Education	Environmental Science	3+0+1	**16**
BVGE-202		Value Education-II	1+0+1	
BVGE-203		Professional Skills Development	1+0+1	
BVSA-201	Skill Component	Basic Organic Horticulture	2+0+2	**24**
BVSA-202		Basic Organic and Natural Farming	2+0+2	
BVSA-203		Integrated Pest and Disease Management	2+0+2	
		Total credit in Semester-II	**11+0+9=20**	**40**

Environmental Science
Course Code- BVGE-201
Credit- 3+0+1 (Lecture+Tutorial+Practical)

Objectives:

This paper helps the students to understand the

1) meaning, nature and scope of different types of natural resources.
2) techniques for sustainable utilization of different resources.
3) policies related to conservation and its related impacts.
4) process of nurturing human resources and different aspects of disaster mitigation.

Theory **48 hrs**

Unit-I: Multidisciplinary nature of environmental studies **2 hrs**

Definition, scope and importance, Need for public awareness.

Unit-II: Natural Resources **12 hrs**

Definition, meaning, nature and scope;

Renewable and non-renewable resources:

a) Forest and wildlife resources: Types, Use and over-exploitation, deforestation, case studies; Timber extraction, mining, dams and their effects on forest and tribal people, forest conservation and management, joint forest management (JFM).

b) Water resources: Water use, Surface and underground water resources: over-utilization, 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: Concept, world food problems, changes caused by agriculture and overgrazing, modern agriculture and environmental problems: fertilizer-pesticide problems, water logging, salinity etc., case studies.

e) Energy resources: Growing energy needs, renewable and non-renewable energy sources, use of alternate energy sources and their environmental impacts

f) Land and soil 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.

Unit-III: Ecosystems **10 hrs**

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)

Unit-IV: Biodiversity and its Conservation **10 hrs**

Introduction – Definition : genetic, species and ecosystem diversity, biogeographical classification of India, value of biodiversity : consumptive use, productive use, social, ethical, aesthetic and option values, biodiversity at global, National and local levels, India as a mega-diversity nation, hot-sports of biodiversity, threats to biodiversity : habitat loss, poaching of wildlife, man-wildlife conflicts, endangered and endemic species of India, conservation of biodiversity : In-situ and Ex-situ conservation of biodiversity.

Unit-V: Environmental Pollution **10 hrs**

Definition; cause, effects and control measures of a. Air pollution, b. Water pollution, c. Soil pollution. Solid waste Management

Unit-VI: Human Population and the Environment **4 hrs**

Human Resource – Concept, Human Resource development; Population growth, variation among nations; Environment and human health; Population, environment and development; Human Rights; Case Studies.

Practical **32 hrs**

1. Visit to a local area to document environmental assets river/forest/grassland/hill/ mountain
2. Visit to a local polluted site-Urban/Rural/Industrial/Agricultural
3. Study of common plants, insects, birds.
4. Study of simple ecosystems-pond, river, hill slopes, etc.
5. Soil test and soil health card preparation (lab. method and farmers' field method)
6. Planting cover crop and contour trench to conserve soil moisture and check soil erosion.
7. Identification of rural resources by using different Participatory rural appraisal (PRA) tools/ questionnaire/ survey etc
    a. Need assessment of skill development training of the village people
    b. Nature of natural disaster occurred, frequency, effect on rural life, concept of rural people about its mitigation, existing system, desired system, gap and action to be taken, formation of a village level task force for disaster management
8. Study of village sanitation and scope of provision of low-cost drinking water and sanitary latrines
9. Generation of environmental awareness among villagers (sanitation and health, afforestation/ joint forest management, Soil and water conservation, Organic farming and animal resource generation,

Suggested Readings:

1. *A textbook of environmental studies by Erach Bharucha, University Press*
2. *A textbook of environmental studies by Asthana and Asthana, S.Chand Pubs.*
3. *Ecology and Environment by PD Sharma, Rastogi pubs.*
4. *Environmental Science by RT Wright, PHI Pubs.*
5. *Population, Environment and Development – Report of UN*
6. *Natural Hazard and Disaster Management – CBSE class XI text book*
7. *Handbook of disaster management by Willium L Waugh, Crest Publishing House*
8. *Natural disaster and environment by Visvajit Gupta, SS Pubs*
9. *Environment problems and solution by Asthana ans Asthana, S.Chand Pubs.*

Value Education-II
Course Code- BVGE-202
Credit- 1+0+1 (Lecture+Tutorial+Practical)

Theory **16 hrs**

Unit-I: Concept and Power of Education **7 hrs**
Swamiji on Education: Definition, need and goal, methods of education, education for the masses, education of women. great educators and their methods: Upanishadic Rishis, Booker T. Washington, R.N Tagore

Unit-II: Essential Moral Virtues **3hrs**
Mercy and self-sacrifice, service, duty, chastity, non-injury, Morality--- its relative aspects, its absolute standard, the utility of morality and ethics, Ethics--- the way and the method. Universal ethics and moral conduct – Swami Vivekananda. great teachers of morality: Socrates, Abraham Lincoln

Life Teachings of Great Personalities **6 hrs**
Swami Vivekananda/ Sri Ramakrishna/ Lord Buddha
Local Leaders- Bhagavan Birsa Munda etc.

Practical **30hrs**
Activities under the National Service Scheme (NSS).

Professional Skills Development
Course Code- BVGE-203
Credit- 1+0+1 (Lecture+Tutorial+Practical)

Theory **16 hrs**

UNIT-I: Basics of Communication **4 hrs**

Concept of communication, models of communication, barriers of communication, formal and informal communication

UNIT-II: Communication Skill **8hrs**

Introduction to effective communication in professional settings, verbal and non-verbal communication skills, written communication: emails, reports, and documentation, listening skills and empathetic communication

UNIT-III: Unit 3: Professional Ethics and Values **2 hrs**

Understanding ethics in professional contexts, Ethical decision-making and dilemmas, Values and integrity in the workplace, Diversity and inclusion awareness

UNIT-IV: Career Development and Employability Skills **2 hrs**

Exploring career pathways and goal setting, Concept of resume, CV, Developing networking and professional relationship-building skills

Practical **32 hrs**

1. Crafting resumes, cover letters, PowerPoint presentation
2. Mock interviews and feedback sessions
3. Networking events and practice
4. Role-playing exercises for practicing effective communication
5. Drafting and reviewing professional emails and reports
6. Attending seminars and guest lectures on career development and employability skills building
7. Workshop on communication skills development

Suggested Readings:

1. *How to Talk to Anyone: 92 Little Tricks for Big Success in Relationships- by Leil Lowndes, McGraw-Hill Education.*
2. *Corporate Chanakya- by Radhakrishnan Pillai, Jaico Publishing House*
3. *Crucial Conversations: Tools for Talking When Stakes Are High- By Kerry Patterson, Joseph Grenny, Ron McMillan, Al Switzler, McGraw-Hill Education*

Basic Organic Horticulture
Course Code- BVSA-201
Credit- 2+0+2 (Lecture+Tutorial+Practical)

Course Objectives

- ✓ *To familiarize with the importance and scope of horticultural crops.*
- ✓ *To understand the organic production practices in horticultural crops.*
- ✓ *To educate about ornamental gardening and lawn management*
- ✓ *To acquaint with orchard planning and management practices*
- ✓ *To develop skills in organic cultivation aspects of horticultural crops [Practical].*

Course Outcome

After completion of this course, the students will acquire basic knowledge about the fundamental aspects of horticulture. The students in turn will find it easier to undergo other horticultural courses in the subsequent semester(s).

THEORY **32 hrs**

UNIT-I: Basic Horticulture **10 hrs**

Definition and branches of horticulture, importance and scope of horticultural crops, classification of horticultural crops, area and production, exports and imports, fruit and vegetable zones of India, vegetable gardens, nutrition and kitchen garden and other types of gardens. Definition of orchards and their different types; systems of planting; bearing habits; factors influencing the fruitfulness and unfruitfulness; training and pruning fruit trees;rejuvenation of old orchards and top working; water management, weed management and fertility management of orchards.

UNIT-II: Horticultural Crop Production by Organic Farming **8 hrs**

Concept of different horticultural crop-based cropping systems in relation to organic farming (like inter cropping, *etc*.), Sources of nutrients for organic horticulture (organic manure, green manures, liquid manures, bio-fertilizers, *etc.*), Recycling of Organic matter in organic horticulture, Organic cultivation of important horticultural crops like vegetables, flowers and fruits.

UNIT-III: Organic Farming in Spices & Condiments, Medicinal & Aromatic Plants **8 hrs**

Origin and distribution–Area and production – Composition and uses –Soil and climate–varieties–propagation–planting–irrigation-nutrition management - weed control – mulching - mixed cropping, intercropping, multi-tier cropping – cover cropping - training and pruning practices-role of growth regulators- harvest and yield- GAP – Organic production of some important spices & condiments – value added products– constraints of spices & condiments; Importance of medicinal & aromatic crops & their parts use, aroma & medicinal constituents, organic package of practices for cultivation of important medicinal and aromatic plants.

UNIT-IV: Ornamental Horticulture and Landscape Gardening **6 hrs**

Importance and scope of gardening; history of gardening; gardens in India; definition, principles, and concepts of landscape gardening; types of the garden; hedge plants and their qualities; lawn: definition, qualities, establishment, and maintenance.

PRACTICAL **64 hrs**

1. Identification of horticultural crops and their seeds/propagules. **4 hrs**
2. Familiarization with garden tools and implements, and their actual operation by working and practicing **4 hrs**
3. Layout of nutrition garden and practice of crop production in nutrition garden. **8hrs**
4. Preparation of seed bed and raising of seedlings of vegetables and flowers. **4 hrs**

5. Familiarization of manures and fertilizers according to source of plant nutrients and requirement of nutrients of different horticultural crops **4 hrs**
6. Visit to vegetables/fruits/flower markets. **4 hrs**
7. Identification of major medicinal crops and their parts used including their products **4 hrs**
8. Identification of major aromatic crops and their essential oil content **4 hrs**
9. Visit to aromatic oil extraction plant **4 hrs**
10. Identification of ornamental plants (annuals, shrubs, trees, herbaceous perennials, climbers & creepers, palms & ferns, cacti &succulents) **4 hrs**
11. Preparation of potting mixture and potting, re-potting practices in ornamental plants. **4 hrs**
12. Visit to institutional garden/parks/sports ground with lawn. **2 hours**
13. Preparation of pits and planting of fruit plants **2 hours**
14. Training and pruning of orchard trees. **4 hours**
15. Visits to commercial orchards/organic farms. **4 hours**
16. Seminar on Government's plans, policies and programmes related to the module. **4 hrs**

REFERENCES

1) Jitendra Singh. 2006. Basic Horticulture. Kalyani Publishers, New Delhi.
2) Chadha, K. L. 2003. Handbook of Horticulture, ICAR, New Delhi.
3) Singh, N.P. 2005. Basic concepts of Fruit Science. International Book Distributing Co., Lucknow.
4) Chattopadhyay, T. K., 2001. A Text Book on Pomology (4 Volumes) Kalyani Publishers, Ludhiana.
5) Pranab Hazra, A. Chattopadhyay, K. Karmakar and S. Dutta. 2010. "Modern Technology in Vegetable Production" New India Publishing Agency, New Delhi.
6) Gopalasamy Iyengar. 1990. Complete Gardening in India. IBH. Bangalore.
7) Randhawa, G.S. and A. Mukhopadyay. 1998. Floriculture in India. Allied publishers Limited, New Delhi
8) K.M.P. Nambisan 1992 – Design Elements of Landscape Gardening – Oxford and IBH publishing Co, New Delhi.
9) Farooqi, M. M. Khan and M. Vasundhara. 2004. Production Technology of Medicinal and Aromatic Crops. Publ. Natural Remedies Pvt. Ltd., Bangalore-561229.
10) Jitendra Singh. 2008. Spices and Plantation Crops. Aavishkar Publishers, Distributors, Jaipur.
11) H.P. Singh and George V. Thomas (2010). Organic Horticulture: Principles, Practices and Technologies, Westvill Publishing House

Basic Organic and Natural Farming
Course Code- BVSA-202
Credit- 2+0+2 (Lecture+Tutorial+Practical)

Theory **32 hrs**

UNIT-I: Organic Farming **3 hrs**

Concept, Objectives, Scope and opportunities and Principles of Organic Farming, Integrated Organic Farming System, Effect of Climate change. An introduction to Vedic agriculture with reference to Vrikshayurveda.

Unit-II Soil Health and its Management **8 hrs**

Importance of soil and its role in crop production, soil properties, nutrient cycle, soil fertility and soil productivity, essential plant nutrients and their functions, and deficiency symptoms. Soil testing: need and techniques. Integrated nutrient management.

Unit-III: Organic Nutrient Management **8 hrs**

- **Different methods of Compost Preparation-**Basics of composting, different methods of composting: FYM, NADEP, Heap Method, Speed Compost, Vermicompost etc.
- **Organic Liquid Manure-** Beeja Sanjivani, Poudh Sanjivani, amritjal, sasyagavya, kunapajala, panchagavya etc.
- **Green Manuring and Azolla:** concept of green manuring and green leaf manuring. Azolla: concept, usages, multiplication techniques
- **Biofertilizers:** Concept, definition, usage in agriculture

Unit-IV: Agronomic Practices in Organic Farming and seed production **13 hrs**

a. Techniques of land preparation in different land types (upland, medium land, and low land), selection of suitable cropsand varieties, crop rotation, integrated weed management, mulching and its benefits, integrated water management, Agroforestry for improving soil fertility, biodiversity and increasing biomass in the farm.
b. Seed industry in India and development of seed programmes. The basic concept of a seed, types of seed, and importance of quality seed. Seed variety: Identification, release and notification. Important varieties of different crops of Jharkhand. General principles of seed production, Seed production of major crops. Hybrid seed production. Production technologies for organic seed. Seed certification and quality control. Seed drying and cleaning. Seed processing. Seed testing, packaging, and labelling. Seed storage: Insect & Pests. Seed storage: Chemical methods. Seed storage: Organic methods. Seed germination. Seed treatment: Chemical method. Seed treatment: Organic method. Seed quality enhancement techniques: Seed hardening and priming. Farmer's participatory seed production. Seed conservation and role of PPVFR. Economics of seed production.

Practical **64 hrs**

1. Preparation and application technique of compost through various methods like NADEP, speed, pit, and heap from crop residues, cow dung as well as poultry litters.
2. Preparation and application technique of organic liquid manures- Sanjivani, Sasyagavya, Kunapajala, Amrit Pani and Panchagavya, vermi-bed wash
3. Green manuring technique

4. Preparation of Azolla Pit and its cultivation
5. Raised bed furrow irrigation technique
6. Techniques of land preparation in different seasons
7. Seed Treatment, Seed sowing and transplanting technique of different crops and vegetables
8. Different types of mulching
9. Preparation of plan for a model organic farm of 1 acre.
10. Soil Sample collection technique
11. Soil testing- Physical, Chemical and Biological Parameters
12. Soil solarization technique
13. Uploading Soil Health Card on the web portal
14. Seed production techniques

Integrated Pest and Disease Management
Course Code- BVSA-203
Credit- 2+0+2 (Lecture+Tutorial+Practical)

Theory **32 hrs**

Unit-I: Pest and IPM **02 hrs**

Definition and Categories of pests, Concept, principles and methods of IPM

Unit-II: Pest of field crops **06 hrs**

Pests of cereals, pulses andoilseed crops and their management,

Unit-III: Pest of horticultural crops 06 **hrs**

Pests of vegetables, fruit crops and spices and their management

Unit-IV: Pests of stored grains **2 hrs**

Pest of stored grains and their management

Unit-V: Basics Concepts of IDM **4 hrs**

- Concepts of Integrated Disease Management
- Principles of Plant disease management: Cultural, Physical, Biological and Chemical methods of Disease management

Unit-VI: Disease management of cereals, pulses and oilseeds **6 hrs**

Symptoms, etiology, epidemiology and management of major diseases of cereals, pulses and oilseeds of Jharkhand**.**

Unit-VII: Disease Management of fruits and vegetables **6 hrs**

Symptoms, etiology, epidemiology and management of fruits and vegetables of Jharkhand.

Practical **64 hrs**

1. Field identification and management of insect pests of cereals
2. Field identification and management of insect pests of pulses
3. Field identification and management of insect pests of oilseed crops

4. Field identification and management of insect pests of vegetable crops
5. Field identification and management of insect pests of fruit crops
6. Field identification and management of insect pests of spices
7. Identification and management of insect pests of stored grain
8. Field visit and diagnosis of Plant diseases
9. Familiarization with plant protection equipments
10. Demonstration of cultural, physical and biological methods of plant disease management
11. Preparation and application of botanicals
12. Calculate the dose of fungicides and methods of fungicides application
13. Demonstration of Spraying and Soil drenching in field

Suggested Readings:

i. *Elements of Economic Entomology- B. Vasanthraj David and V. V. Ramamurthy*
ii. *Agricultural Pest of South Asia and their managemetn- A. S. Atwal and G.S. Dhaliwal*
iii. *Text book of Applied Entomology (Vol. II)- K.P. Srivastava and G.S. Dhaliwal*
iv. *Applied Entomology- D.S. Reddy*
v. *A text book of Fungi, Bacteria and Viruses: H.C.Dube*
vi. *Introduction to principles of Plant Pathology: R.S. singh*
vii. *Plant disease: R.S. Singh*

Semester-III

Course Code	Course Component	Course Title	Credit	Cumulative Credit
BVGE-301	General Education	Extension Education-II	1+0+1	**24**
BVGE-302		Practice of Yoga	1+0+1	
BVGE-303		Agro-based Biotechnology	2+0+2	
BVSA-301	Skill Component	Fundamentals of Soil and Water Conservation	2+0+2	**36**
BVSA-302		Applied Horticulture	2+0+2	
BVSA-303		Crop Production Technology	2+0+2	
		Total credit in Semester-III	**10+0+10=20**	**60**

Extension Education-II
Course Code- BVGE-301
Credit- 1+0+1 (Lecture+Tutorial+Practical)

Theory **16 hrs**

Unit-I: Monitoring and evaluation **2 hrs**

Concept and definition, monitoring and evaluation of extension programmes.

Unit-II: Rural Leadership and Group Dynamics **4hrs**

a. Rural Leadership: concept and definition, types of leaders in rural context; extension administration: meaning and concept, principles and functions.

b. Group: Definition, characteristics, and types of group morale, group dynamics methods of group work principles and processes of involving people.

Unit-III: System of extension in India **4hrs**

Early extension efforts including Swami Vivekananda concept of rural and tribal development in India; Community Development programmes; ICAR extension system; various extension/ agriculture development programmes launched by ICAR/ Govt. of India (IADP, IAAP, HYVP, KVK, IVLP, ORP, NATP, NAIP, etc.).

Unit-IV: Participatory Rural Appraisal (PRA): Tools and Techniques **6 hrs**

Origin of PRA, Principles and features of PRA. PRA and Rural Development; General tools and specific tools of PRA household interview, review of secondary data. PRA tools- Participatory mapping, activity calendar, mobility map, seasonality calendar, time-line, mapping, transect mapping, decision making matrix etc.

Practical: **32 hrs**

1. Rural Living to use of techniques to select rural leaders. **4 hrs**
2. Study of Cropping/Farming Systems under different resources and situation. **8 hrs**
3. Exercising different tools of PRA in village situation during rural living. **12 hrs**
4. Study of rural development progammes undertaken by *Ramakrishna Mission Ashama,* Ranchi in agriculture and allied activities **8 hrs**
5. Seminar on the module overview at the end of the semester. **8 hrs**

Suggested Readings:

1. PRA – Methodology & Applications – Neela Mukherjee – Concept Publishing.

2. Farmers' Participation in Agril. Research & Extension systems- S.K.Arora.

3. Extension communication and Management – G.L. Ray, Kalyani Publishers.

4. Agricultural Extension: Impact and Assessment/A.K. Singh. Reprint. Jodhpur, Agrobios, 2003.

Practice of Yoga
Course Code- BVGE-302
Credit- 1+0+1 (Lecture+Tutorial+Practical)

Theory **16 hrs**

Unit-I: About Yoga **3 hrs**

What is Yoga? Brief history and development of Yoga. The Fundamentals of Yoga. Traditional Schools of Yoga. Yogic practices for health and wellness. General Guidelines for Yoga Practice.

Unit-II: Sadilaja /Cạlana Kriyas/Loosening Practices **3 hrs**

Neck Bending, Trunk Movement, Knee Movement

Unit-III: Yogasanas **8 hrs**

Standing Posture- Tādāsana, Vṛikṣāsana, Pāda-Hastāsana, Ardha Cạ krāsana, Trikoṇāsana,

Siting Posture- Bhadrāsana, Ardha Uṣṭrāsana, Sasānkāsana, Vakrāsana

Pron Postures-Bhujangāsana, Salabhāsana, Makarāsana

Supine Postures- Setubandhāsana, Pavanamuktāsana, Savāsana

Unit-IV: Kapālabhāti and Pranayama **2 hrs**

Nadisodhana / Anuloma Viloma Prāṇāyāma, BhramriPrāṇāyāma

Practical **32 hrs**

Practice of Yoga

Note-*This curriculum has been adopted from the 'Common Yoga Protocol' of the Ministry of AYUSH, Government of India.*

Agro-based Biotechnology
Course Code- BVGE-303
Credit- 2+0+2 (Lecture+Tutorial+Practical)

Objectives:

This paper helps the students to familiarize with:

1. The basics of biotechnology and its application to agriculture.
2. The handling and use of different laboratory equipment.
3. the basics of laboratory techniques.
4. The technology of production of biofertilizers and bio fungicides.
5. The plant tissue culture techniques.
6. The essentials of soil biotechnology.

Theory **32 hrs**

Unit-I: Concept of Agricultural Biotechnology **3hrs**

1. Definition of biotechnology and its importance (with special reference to Agricultural Biotechnology)

1.1 Definition, different concepts of biotechnology, related subjects. 1 hr

1.2 Related scientists and their contribution. 1 hr

1.3 Field related with biotechnology and its importance. 1 hr

Unit-II: Soil Microbiology **5hrs**

2. Introduction to soil microbiology

2.1 Soil – definition, its constituents, 1 hr

2.2 Rhizosphere, phyllosphere; microbial flora of soil. 2hrs

2.3 Bacteria, Fungi, Actinomycetes, algae, protozoa, their classification. 2hrs

Unit-III: Basic Laboratory Techniques **10hrs**

3. Introduction to basic laboratory techniques

3.1 Instruments and equipment of microbial culture, different types of media, their preparation method and importance. 1 hr

3.2 Invitro and in vivo practice. 1 hr

3.3 Microbial growth and their requirements, gaseous requirements of bacteria. 1 hr

3.4 Microbial cell culture techniques- a) aerobic b) anaerobic 2hrs

3.5 Preservation and maintenance of microbial culture- Periodic transfer, mineral oil method; brief idea about lyophilization and low temperature storage. 1hr

3.6 Biofertilizer, types of biofertilizer, microbial biofertilizer with special reference to *Azotobacter spp.,* Phosphate solubilizing microorganisms, *Azospirillum spp.* and *Rhizobium spp.;* their mass production (isolation to mass culture), advantages and disadvantages. 2 hrs

3.7 Biopesticides, botanical pesticides, microbial biopesticides - *Trichoderma sp.*, *Beauveria bassiana, Pseudomonas fluorescens, Bacillus thuringiensis, Bacillus subtilis* etc.; their mass production (isolation to mass culture), advantages and disadvantages. 2 hrs

Unit-IV: Soil Biotechnology **4hrs**

4. Soil biotechnology

4.1 Introduction- Nitrogen cycle, carbon cycle, Phosphorus cycle, sulphur cycle. 2hrs

4.2 Biological nitrogen fixation, 1 hr

4.3 Mycorrhizae, types of mycorrhizae and its mass production 1 hr

Unit-V: Plant Tissue Culture Technique **10hrs**

5. Introduction to Plant Tissue Culture

5.1 History of plant tissue culture; concept of totipotency; aseptic culture practices 1 hr

5.2 Components of in vitro culture media and role of different macro and micro nutrients, vitamins, plant growth regulators and growth supplements; Sterilization techniques. 2 hrs

5.3 Various plant cell, tissue and organ culture techniques and uses; 2 hrs

5.4 Somatic cell cultures; morphogenesis: organogenesis and somatic embryogenesis 2hrs

5.5 Production of secondary metabolites; Synthetic seeds; 1 hr

5.6 Micropropagation: In vitro grafting, meristem culture; Anther, pollen, embryo, ovule, ovary culture; Protoplast culture and somatic hybridization; Somaclonal variation. 2 hrs

Practical **64 hrs**

1. Good laboratory practices 1 hr

2. Characterisation and identification of laboratory equipment. 2 hrs

3. Preparation of media with pH adjustment. 2 hrs

4. Sterilization of media and glassware. 1hr

5. Serial dilution method, Total plate count. 2 hrs

6. Inoculation techniques; streak plate, pour plate, spread plate. 2 hrs

7. Preservation of pure cultures. 1hr

8. Isolation of microbial biofertilizer and mass cultivation, application. 24 hrs

9. Azolla production and application. 2 hrs

10. Mycorrhizae production and application. 2 hrs

11. Tissue culture

11.1 Good laboratory practices; 2 hrs

11.2 Media preparation and sterilization; 3 hrs

11.3 Surface sterilization of explants; 3 hrs

11.4 Establishment of callus/cell suspension cultures; 5 hrs

11.5 Micropropagation; Embryo culture; Anther and pollen culture; 8hrs

11.6 Induction of plant regeneration; Hardening and transfer to soil. 5 hrs

Fundamentals of Soil and Water Conservation
Course Code- BVSA-301
Credit- 2+0+2 (Lecture+Tutorial+Practical)

Theory **32 hrs**

Unit-I: Soil Management **6 hrs**

Conservation agriculture: Concepts, Principles, Application; Organic Farming vs. Natural Farming; Dryland agriculture: concepts and types (Dry, Dryland and Rainfed Farming), Differences between Dryland vs. Rainfed farming.

Unit-II: Water Management **8 hrs**

Movement of water in soil (Runoff, Infiltration, Percolation, Deep Percolation Seepage); Role of water in Soil and Plant; Types and Concept of Irrigation; Micro Irrigation (Sprinkler, Drip); Hydrology and hydrological cycle, Evaporation and Evapotranspiration, Crop water Requirement, Water Use Efficiency-Concept, factors and strategies to improve.

Unit-III: Soil and Water Conservation **6 hrs**

Soil Erosion (Water and Wind Erosion): Factors affecting Soil Erosion, Types of Water Erosion, Types and Stages of Gully Erosion, Process of Wind Erosion, Universal Soil Loss Equation; Agronomical and Mechanical measures for Soil Conservation.

Unit-IV: Watershed Development and Management **6 hrs**

Watershed: Concepts, Characteristics and classification; Principles, Objectives and Benefits of Watershed Development and Management; Water Harvesting: Concepts, Types and Techniques; Rain Water Harvesting; Concepts and Knowledge of Percolation Tank, Gravity Irrigation, Lift Irrigation System, Minor Irrigation Tanks.

Unit-V: Soil Surveying and Levelling **6hrs**

Surveying: Definition and Types; Chain Surveying; Levelling: Concepts, Types and Benefits in Agriculture; Basic Concepts of different Surveying and Levelling Equipments.

Practical **64 hrs**

1. Studies on Different Soil Management Practices.
2. Methods of Irrigation for Crops (Surface Irrigation).
3. Drip and Sprinkler Irrigation: Components, Design and Application.
4. Studies on Mechanical (Engineering) Measures of Soil Conservation.
5. Studies on Principles and Types of Chain Surveying.
6. Computation of area of Regular and Irregular fields.
7. Studies on Techniques of Rain Water Harvesting.
8. Studies on Techniques of Pipe Fittings and Welding.
9. Studies on Different Components of Watershed (Visit to a water management research station).

Applied Horticulture
Course Code- BVSA-302
Credit- 2+0+2 (Lecture+Tutorial+Practical)

Theory **32 hrs**

UNIT-I: Basics of Propagation **2 hrs**

Need and potentialities for plant multiplication, sexual and asexual methods of propagation, advantages, and disadvantages.

UNIT-II: Asexual Propagation and Media for Propagation **6 hrs**

Asexual propagation and its importance; Containers and media in plant propagation; Techniques of propagation through specialized organs, corm, runners, suckers. Propagation by cuttings: Root, leaf and stem cuttings; Plant propagation by layering–Simple, serpentine, mound and air layering; Plant propagation by grafting– approached and detached (whip, cleft, side veneer and bark); Plant propagation by budding ‘ T’, patch and chip budding techniques.

UNIT-III: Nursery Management Practices **4 hrs**

Nursery- Definition, classification, importance, components, site selection, layout, types of nursery beds – flat beds, raised beds, and sunken beds, their merits and demerits; Nursery structures- Mist chamber, shade nets, lath houses, cold frames, hotbeds, poly-houses, potting, re-potting; different nursery techniques and their management.

Unit-IV: Mushroom Production Technology **10 hrs**

Introduction & History of mushroom cultivation; Biology of mushrooms; Nutritional value (Proteins, amino acids, mineral elements, carbohydrates, fibers, vitamins); Medicinal value of mushrooms; Edible (*Pleurotus*, *Volvariella* and *Agaricus*) & Poisonous mushrooms; Cultivation technology of mushroom – Equipment, Preparation of culture, Mother spawn production, Multiplication of spawn, Cultivation techniques, Harvesting, Packing and Storage; Problems in

cultivation of mushroom – Diseases, Insects-pests, Nematodes & Weed moulds and their management strategies; Cultivation of important mushrooms in on- & off-season: Milky mushroom (*Calocybe indica*), Button mushroom (*Agaricus bisporus*), Oyster mushroom (*Agaricus bisporus*) and Paddy-straw mushroom (Volvariella volvaceae); Economics of cultivation, post-harvest technologies.

Unit-V: Food Processing **10 hrs**

Food processing and preservation techniques for cereals, pulses, nut, oilseeds, milk, fruits and vegetables, egg, meat, fish, spices, herbs, sugar & related products, etc.; Food preservation & Food additives; Methods of food preservation; Physico-chemical characteristics, nutritional quality and shelf-life studies of processed food products; Factors affecting quality of processed foods; Food packaging, package functions, requirement, packaging materials and nutrient labelling; Adulterants and its types; Principles in the development of protective packaging; Shelf-life of packed food; Special problems in packaging of foodstuffs; Food laws, Food Standards & Regulation Agencies in India, International Standards.

Practical **64 hrs**

1. Preparation of media for propagation of plants in nursery beds, pot and mist chamber.
2. Preparation of nursery beds and sowing of seeds.
3. Preparation of pot mixtures, potting and repotting of plants
4. Hardening plants in the nursery.
5. Nursery tools and implements and their application.
6. Practicing different types of cuttings.
7. Practicing different types of layering.
8. Practicing different types of buddings.
9. Practicing different types of grafting.
10. Structure for business of mushroom production farm – Construction of cultivation room and disinfection.
11. Compost preparation & pasteurization for mushroom production.
12. Procurement of mother culture and spawn preparation.
13. Procurement of casing soil and preparation for production.
14. Mushroom seeding, casing with soil and maintenance, harvesting, processing, grading, packing & marketing.
15. Economics of mushroom cultivation.
16. Cereal and vegetable cookery.
17. Preparation of soups, salads and beverages.
18. Use of milk and milk products and eggs in various preparations.
19. Estimation of shelf-life of packaged foodstuffs.

Crop Production Technology
Course Code- BVSA-303
Credit-2+0+2 (Lecture+Tutorial+Practical)

Objectives:

The paper familiarizes the students with the -

- **a.** Acquire skills in crop production.
- **b.** Apply various improved agronomic practices that can bring about enhancement in crop yield.
- **c.** Control pests, weeds, and diseases for enhanced yield.

Theory **32 hrs**

Unit-I: Principles of Production Technology **4 hrs**

Importance, area and distribution, botanical description, soil and climatic requirements, productivity and varieties of major cereals, pulses, oilseeds, commercial crops, fiber and fodder crops of India.

Unit-II: Production Technology of Cereals **10 hrs**

Rice, Wheat, Maize, Finger millet

Unit-III: Production Technology of Pulses **4 hrs**

Black Gram, Green gram, Chickpea, Pea

Unit-IV: Production Technology of Oilseeds **4 hrs**

Rapeseed-Mustard, Sunflower, Groundnut, Soybean

Unit-V: Production Technology of Commercial and Fibre crops **6 hrs**

Sugarcane, Jute, Cotton

Unit-VI: Production Technology of Fodder Crops: **4 hrs**

Berseem, cowpea, Napier, Maize

Practical: **64 hrs**

1. Observation of crop fields.
2. Estimation of seed, manure, and fertilizer requirements
3. Identification of manures and fertilizers.
4. Usage of tools, implements, and machineries for land preparation and other intercultural operations.
5. Application of various ways of seed treatment.
6. Methods of manures and fertilizer application.
7. Methods of irrigation application and drainage of excess water.
8. Estimation of methods of herbicide application and sprayer calibration.
9. Estimation of yield of various crops.
10. Estimation of cost of cultivation and benefit-cost ratio.
11. Identification of different weeds of main crops of Jharkhand.

12. Practices to manage weeds, insect pests, and diseases in crop fields.
13. Working at organic agronomic plots for crop production.
14. Application of ITK/organic farming practicesfor crop production.
15. Practices of different ways of harvesting and post-harvest operations.
16. Visit to organic farms.

Suggested Readings:

1. Textbook of field Crops production, Volume 1 & 2 – Dr. Rajendra Prasad, ICAR publication.
2. Modern Techniques of Raising Field Crops- Chidda Singh, Rajbir Singh & Prem Singh, CBS Publishers and distributors
3. Textbook of Field Crops– Mukund Joshi, PHI Publications.
4. Handbook of Agriculture – ICAR publication.
5. Agronomy of Field Crops – S R Reddy, Kalyani Publications.

Semester-IV

Course Code	Course Component	Course Title	Credit	Cumulative Credit
BVGE-401	General Education	Entrepreneurship Development	2+0+1	**32**
BVGE-402		Value Education-IV	1+0+1	
BVGE-403		Agri-marketing and Cooperatives	2+0+1	
BVSA-401	Skill Component	Secondary Agriculture	2+0+2	**48**
BVSA-402		Advanced Organic Horticulture	2+0+2	
BVSA-403		Crop Cafeteria and Gardening	0+0+4	
		Total credit in Semester-IV	**9+11=20**	**c80**

Entrepreneurship Development
Course Code- BVGE-401
Credit- 2+0+1 (Lecture+Tutorial+Practical)

Theory **32 hrs**

Unit-I: Entrepreneur and Entrepreneurship: Perspective 14 hrs

i. **Entrepreneur and Entrepreneurship**: Definition and Concepts, Entrepreneurial decision process. Functions, need and types of entrepreneurs. Intrapreneurs and social entrepreneurs. Concept and growth of entrepreneurship in India. Role of entrepreneurship in economic development.
ii. **Women entrepreneurship**: Concept and functions. Growth, problems and limitations.
iii. **Rural entrepreneurship:** Meaning and need. Rural entrepreneurship vs industrialization, Problems.
iv. **Agri-Preneurship**: Meaning, need, opportunities, and challenges, Developing agri-preneurship.
v. **Social- entrepreneurship and family business**: Meaning and perspective, boundaries Meaning and types of family business, advantages, challenges and way forward.
vi. **Factors affecting entrepreneurial growth**: Economic, non-economic, government.
vii. **Entrepreneurial Motivation**: Meaning. Motivational process, theories and factors. Achievement motivation. Entrepreneurial motivation behaviour.

Unit-II: Entrepreneurial Start-ups 10 hrs

i. **Micro, Small and MediumEnterprises –** Meaning, definition of micro, small and medium enterprizes. Role of micro-enterprises in economic development. Challenges before MSMEs in India.
ii. **Understanding the project cycle-** Identification and selection of business opportunities. Steps in setting up a small enterprise. Formulating project report and network analyses, SWOT/SLOC analysis.**Project appraisal:** Concept and need for project appraisal. Methods: Economic, financial, market, technical and managerial competence. Project monitoring and Evaluation.
iii. **Forms of business ownership**: Sole proprietorship, partnership, company, cooperative. Selection of appropriate form of ownership.

Unit-III: Entrepreneurship: Growth and Development 8hrs

i. **Intellectual property rights and MSMEs:** IPR and MSMEs: Patents, copyrights, trademarks, GIs, Industrial designs, trade secrets, integrated circuits, Protection of new plant varieties. Need for IPR for MSMEs. Problems.

ii. **Growth and sickness in Small-scale enterprises:** Objectives and stages of growth. Types of growth strategies. Meaning, process and symptoms of industrial sickness. Causes, consequences and remedial measures.
iii. **Social responsibility for business**: CSR-need. Forms and dimension.
iv. **Government schemes and other initiatives to promote entrepreneurship in the country**-

Practical **32 hrs**

1. Case study of some self-employed individual (Entrepreneur).

2. Techniques of SWOT analysis.

3. Preparation of schedule for the Market survey.

4. Preparation of business project proposal.

5. Break-even analysis and financial ratio analysis.

6. Visit to a micro/small/medium enterprise.

Suggested Readings: -

i. Verma, S.B. 2005. Entrepreneurship and Employment. Deep and Deep Publishers Pvt. Ltd. New Delhi.
ii. Deghania,P.&Mahato,L.N. Rural entrepreneurship development, Classical
iii. S.S.Khanka. Entrepreneurial development. S.Chand.
iv. Swanirbhar ki Or Vol-I, RKM-Ranchi
v. R.K Sahu. Training for Development, Excel Books.
vi. ***J ournal:*** *1) Laghu Udyog Samachar 2) Yojana.*

Value Education-III
Course Code- BVGE-402
Credit- 1+0+1 (Lecture+Tutorial+Practical)

Theory **16hrs**

Unit-I: Duty towards our motherland **5hrs**
Swamiji's instruction for the enlighten citizens. Our duty towards our motherland and the society.

Unit-II: Building of Human Character **5hrs**
Character: definition, how to build character? Importance of willpower in our lives; How to develop willpower? Role of Social Service in Personality growth: The ideal of service in Ramakrishna Mission.

Unit-III: Lessons from the Great Personalities **6hrs**
Maa Sarada/ Sister Nivedita/ Laxmi Bai/ Savitribai Phule

Practical **32hrs**

1. Social Service.
2. Activities in spreading adult/child education.
3. Building awareness among the masses through the campaign.
4. Quiz, Group Discussion, Seminar, Mock interview, Role-playing on the related topics

Agri-Marketing and Cooperatives
Course Code- BVGE-403
Credit- 2+0+1 (Lecture+Tutorial+Practical)

Objectives:

This paper helps the students to familiarize with:

1. The concepts and aspects related to traditional and rural marketing systems.
2. The evolving concepts in the modern marketing systems.
3. The marketing services, channels and agencies involved in rural marketing.
4. The different Act and policies to improve the rural marketing systems

Theory **32 hrs**

Unit-I: Market and marketing **6 hrs**

i. Agricultural marketing: Market: Meaning. Definition. Scope and subject matter. Role of agricultural marketing. Difference with marketing of manufactured goods
ii. Market price: importance of efficient market price. Price determination vs price discovery. Concept of market price determination using demand and supply. Cost of Cultivation- Cost A1, A2, B and C and Minimum Support Price (MSP) calculation.
iii. Producer's surplus: meaning and types. Marketable and marketed surplus: Relationship. Factors affecting marketable surplus. Price and marketed surplus.

Unit-II: Marketing functions, agencies, institutions and channels **12 hrs**

i. Marketing functions: Meaning and classifications
ii. Packaging. Transportation. Grading, standardization and quality control. Processing and value addition. Storage and warehousing. Buying and selling.
iii. Agencies and institutions in marketing.
iv. Marketing channels: meaning and importance. Factors affecting length of marketing channels.

Unit-III: Market integration, efficiency, costs, margins and price spread **5 hrs**

i. Market integration: meaning and types. Forward and backward integration.
ii. Marketing efficiency: Meaning, Assessment of marketing efficiency.

Unit-IV: Cooperative marketing **3 hrs**

i. Meaning, motive, and principles of cooperation. Advantages. Structure. Role of PACS.
ii. Cooperative marketing. Indian Farmers Fertiliser Cooperative (IFFCO), National Agricultural Cooperative Marketing Federation of India (NAFED), National Agricultural Cooperative Marketing Federation of India (NCDC), ribal Cooperative Marketing Development Federation Of India (TRIFED), Marketing Federations (MARKFED), Self-help Groups (SHG) and others. Jharcraft. Vegfed. Farmer Producer organisations (FPO).

Unit-V: Government support and external trade **6 hrs**

i. Contract farming/ contract marketing: Models, importance and problems. Future scope.

ii. Wholesaling in agricultural marketing. Regulated marketing. Agricultural produce market committee Act (APMC Act). Model APMC Act- Recent developments.
iii. Price support policies: MSP, procurement price etc. need and importance.
iv. Digital marketing. National Agriculture Market (e-NAM) and other online platforms.
v. External trade: importance, requirements. Role of Agricultural and Processed Food Products Export Development Authority (APEDA).

Practical **32 hrs**

1. Study of development of marketing system in India- Review of development of various marketing models for agricultural commodities in India and the world (From traditional marketing to innovative marketing models)
2. Study on prices and arrivals of agricultural commodities in various markets in India, including APMC mandies, online platforms (Mobile apps like Vivek Jaivik Krishi, Kisan Suvidha, Crop Doctors etc.).
3. Estimation of cost of cultivation (cereal, vegetable, pulses and oilseeds, livestock etc.) marketable and marketed surplus of agricultural commodities.
4. Study of performance of existing marketing channels for agricultural and allied commodities in Rural and Tribal areas of Jharkhand- efficiency analysis, producers' share in consumer rupee, costs and margins and net returns.
5. Visit to a cooperative marketing organization/ FPO (Vivekananda Madhu UtpadakSwavalambiSahakari Samiti) in Jharkhand to study its functioning.
6. Study of various laws and schemes in India to promote agricultural marketing- contract farming, direct marketing, online marketing (e-NAM) etc.
7. Study of marketing performance of SHGs.

Suggested Readings:

i. S. S. Acharya and N L Agarwal. Agricultural Marketing in India. Oxford & IBH Publishing Co. Pvt Ltd (2012).
ii. Verma, S.B, Jiloka, S.K and Mondal, B. 2006 Rural Agriculture and Marketing. Deep and Deep Publishers Pvt. Ltd. New Delhi.
iii. Singh, Kumar, A and Pandey, S.P. 2005. Rural Marketing: Indian Perspectives. New Age International Publishers.

Secondary Agriculture
Course Code- BVSA-401
Credit- 2+0+2 (Lecture+Tutorial+Practical)

Objectives:

The paper familiarizes the students on the -

a) impart basic knowledge and develop skills about propagating different types of plants by seed, cuttings, budding and grafting, separation, division, layering as well as micro-propagation in a commercially viable way;
b) Refinement in mushroom cultivation technology by enhancing the entrepreneurial skills;
c) Acquaint with food preservation for enhancing the food quality and minimizing spoilage;
d) Infuse entrepreneurial skills of commercialization of nursery & mushroom production and food processing.

Theory **32 hrs**

Unit-I: Introduction to Fishery **10 hrs**

Basics of Fish farming: concept and scope, Fish Farming Methods: Pond culture, Pen culture, Cage culture, Running water culture & Zero water exchange system; Preparation and management of pond; Role of pond plankton and pH; Pond fertilization (agro-wastes, manures, fertilizers & bio-fertilizers); Pre-stocking and post-stocking pond management; Stoking capacity of pond; Factors influencing carrying capacity; Criteria for selection of fish species for aquaculture; Feeding of fishes; Wastewater aquaculture; Prevention and control of fish diseases; Fish induced breeding; Monoculture, poly-culture & integrated Fish culture systems and its economics; Water and soil quality in relation to fish production; Physical, chemical and biological factors affecting productivity of ponds; Catfish culture & Prawn culture.

Unit-II: Introduction to Lac Culture **10 hrs**

Lac growing areas in India; Lac insects – Biology, Behaviour; Lac cultivation, Different Strains &Food plants, Pruning, Inoculation, Cropping and management of plants; Harvesting, Grading, Processing and Storage of lac; Kinds of lac; Enemies of lac-insects; Cultivation of Kusumi lac in Indian plum plantation; Cultivation of lac in Kusum, Semiyalata, Palash and other plantation.

Unit-III: Introduction to Apiculture **12 hrs**

Introduction to beneficial insects. Importance and History of apiculture. Species of honey bees, Rock bee, Little bee, Indian bee, European bee, Italian bee and Dammar bee, lifecycle and caste determination. Bee colony maintenance, bee colony activities, starting of new colony, location site, transferring colony, replacement of queen, combining colonies, swarm prevention, colony management in different seasons, Equipment for apiary, types of bee hives and their description. Bee pasturage. Honey extraction, honey composition and value, bee wax and tissues.

Practical: **64 hrs**

1. Preparation & management of pond; Identification of fishes and Components of aquaculture farms.
2. Estimation stoking capacity of pond.
3. Practices on pre-stocking and post-stocking management.
4. Growth studies in aquaculture.
5. Aeration and water replenishment in the culture of fish pond.
6. Study on waste accumulation in aquaculture system (NH_3, Organic matter, CO_2) & Analysis of manure.
7. Regular inspection of fish pond to prevent it from aquatic weeds and insects.
8. Marketing & procurement of seeds and formation of fishery co-operatives through SHGs.
9. Visit to fish farms.
10. Honey bee colony, different bee hives and apiculture equipment.
11. Summer and winter management of colony.
12. Honey extraction and bottling.
13. Study of pests and diseases of honeybees.
14. Visit to apiculture farms.
15. Identification of plants for lac cultivation.
16. Cropping and management of plants for lac cultivation.

17. Lac insects-biology, behaviour, lac cultivation, food plants, pruning, inoculation, cropping, kinds of lac.
18. Enemies of lac insects and adoption of protective measures.
19. Cultivation of lac in Kusum, Semiyalata, Palash, and other plantations.
20. Visit to lac farms.

Suggested Readings:

i. *Singh, S., 1975. Bee keeping in India – ICAR, New Delhi., 214p.*
ii. *Sunita, N.D, Guled ,M.B, Mulla S.R and Jagginavar,2003, Beekeeping, UAS Dharwad*
iii. *Mishra, R.C. and Rajesh Gar. 2002. Prospective in Indian Apiculture. Agrobios, Jodhpur.*
iv. *Singh, D and Singh, D.P. 2006. A hand book of Beekeeping, Agrobios (India).*
v. *Singh, S. 1975. Bee keeping in India. ICAR, New Delhi.*
vi. *Glover, P.M. 1937. Lac cultivation in India. Indian Lac Research Institute, Ranchi.*
vii. *Jolly, M.S. 1987. "Appropriate sericulture techniques" International centre for training and Research in Tropical Sericulture, Mysore, 209.*
viii. *K.P.Srivastava .A Text Book on Applied Entomology Vol. I&II. , Kalyani Publishers, Ludhiyana*
ix. *B.r. David and V.V.Ramamurthy. Elements of Economic Entomology, 7th Edition. Namrutha Publications, Chennai*

Advanced Organic Horticulture
Course Code- BVSA-402
Credit- 2+0+2 (Lecture+Tutorial+Practical)

Course Objectives

- To impart knowledge on protected cultivation of vegetables, fruits and flowers.
- To sensitize the students on hi-tech production technology of fruits, vegetables and flower crops through vertical farming.
- To familiarize the students with high density planting technology in different fruits
- To understand good production practices for medicinal and aromatic plants

Theory **32 hrs**

Unit-I: Protected Cultivation and Protective Structures **6 hrs**

Importance and scope of protected cultivation – different growing structures of protected culture *viz*., greenhouse, poly house, net house, poly tunnels, screen house, protected nursery house - study of environmental factors influencing greenhouse production – cladding / glazing / covering material – ventilation systems –micro irrigation and fertigation systems.

Unit-II: Organic Cultivation Practices for Horticultural Crops under Protection **8 hrs**

Protected cultivation technology for vegetable crops, Hi-tech protected cultivation techniques for tomato, capsicum, cucumber, strawberry, etc. – integrated pest and disease management –

postharvest handling. Protected cultivation technology for flower crops, Hi-tech protected cultivation of cut roses, carnation, gerbera, anthurium, etc. – integrated pest and disease management – postharvest handling.

Unit-III: Vertical Farming &Good Production Practices for Medicinal and Aromatic Plants **12 hrs**

Vertical Farming- History, Techniques- Hydroponics, Aquaponics, Aeroponics, Controlled-environment agriculture; Types of Vertical Farming- Building-based Vertical Farms, Shipping-container Vertical Farms, Deep Farms; Advantages; Problems

Medicinal Plants: (a) Selection of varieties; (b) Good production packages; (c) Good harvesting practices; (d) Plant protection; (e) Medicinal importance; (f) Extraction procedures of alkaloids/medicinal properties, *etc.* of some important medicinal plants of eastern India.

Aromatic Plants: (a) Selection of varieties; (b) Good production packages; (c) Good harvesting practices; (d) Plant protection; (e) Commercial importance; (f) Extraction procedures of aromatic oils/components *etc.* of some important aromatic plants of Jharkhand.

UNIT-IV: High Density Orcharding & Related Practices **6 hrs**

High density planting-concept, types and components; Present scenario in HDP in different fruit crops: Temperate, tropical, sub-tropical fruits and plantation crops; HDP-technologies for important fruits; Advantages and Constraints in adoption of HDP systems.

Practical **64 hrs**

1. Study of different protected structures–designs, components, orientation and construction of greenhouse. **4 hrs**
2. Raising seedlings of vegetables/ flowers in pots/ pro-trays **4 hrs**
3. Study of different media, solarization, and fumigation for greenhouse cultivation. **4 hrs**
4. Study special cultural practices for producing vegetables and flowers under protected cultivation. **4 hrs**
5. Soil EC, Organic Carbon, NPK, and pH measurement of protective structures like greenhouse / poly house **4 hrs**
6. Visit to established green/poly house/net house/shade house in the region. **4 hrs**
7. Protected cultivation practices of important horticultural crops. **10 hrs**
8. Performance trial of vertical farming techniques / pot grown vegetables and flowers by the students **12 hrs**
9. ITK practices for crop regulation in fruit tress like bending in guava **2 hrs**

10.	Visit to high density commercial orchards.	**4 hrs**
11.	Extraction of aromatic oil from aromatic plants.	**4 hrs**
12.	Visit to commercial medicinal and aromatic plant unit/garden.	**4 hrs**
13.	Seminar on Government's plans, policies and programmes related to the course.	**4 hrs**

Suggested Readings:

i. *Bose, T. K., S. K. Mitra and D. Sanyal, 2001. Fruits: Tropical and subtropical. Volume I. Naya Udyog, Calcutta.*
ii. *Bridwell. 1992. Hydroponic Gardening.*
iii. *Chadha K. L.1995. Advances in Horticulture. Vol. XII. Malhotra Publ. House.*
iv. *EIRI Board. (2007). Handbook of Medicinal and Aromatic Plants: Cultivation, Utilisation and Extraction.*
v. *Joe. J. Hanan. 1998. Green houses: Advanced Technology for Protected Horticulture, CRC Press, LLC. Florida.*
vi. *Prasad S and Kumar U. 2003. Commercial Floriculture. Agrobios.*
vii. *Prasad S and Kumar U. 2005. Greenhouse Management for Horticultural Crops. Agrobios (India), Jodhpur.*
viii. *Reddy S, Janakiram B, Balaji T, Kulkarni S & Misra RL. 2007. Hi-tech Floriculture. Indian Society of Ornamental Horticulture, New Delhi.*
ix. *Taft. L. 1997. Green House Management, Forcing of Flowers, Vegetables and Fruits. Daya Publishers House, New Delhi*
x. *Tiwari G. N. 2003. Green House Technology for Controlled Environment. Narosa Publ. House.*

Crop Cafeteria and Gardening
Course Code- BVSA-403
Credit- 0+0+4 (Lecture+Tutorial+Practical)

Students will be engaged to cultivate different types of horticultural / field crops.

Semester-V

Course Code	Course Component	Course Title	Credit	Cumulative Credit
BVGE-501	General Education	Scientific Communication Skills and Integral Personality Development	1+0+1	**42**
BVGE-502		Post-Harvest Management and Value Addition	2+0+2	
BVGE-503		Agri-Business Management	2+0+2	
BVSA-501	Skill Component	Advanced Organic and Natural Farming	2+0+2	**58**
BVSA-502		Experiential Learning Programme (ELP)	0+0+6	
		Total credit in Semester-V	**7+13=20**	**100**

Scientific Communication Skills and Integral Personality Development
Course Code- BVGE-501
Credit- 1+0+1 (Lecture+Tutorial+Practical)

Theory **16 hrs**

Unit-I:Advance communication **4 hrs**

Basics of communication, Communication models, understanding nuances of language and tone in communication, Communication skills- verbal, non-verbal, listening and writing.

Unit-II: Critical Thinking **4 hrs**

Introduction to critical thinking – Benefits - Barriers – Reasoning—Arguments Deductive and inductive arguments, Critical thinking in communication

Unit-III: Integral Personality Development **4 hrs**

Personality: an introduction; it is personality that matters, Characteristics of a Well-integrated Personality, Factors Influencing Integrated Personality Development, Levels of Personality development (Physical Development, Mental Development, Emotional Development, Moral Development, Social Development)

Unit-IV: Motivation **2 hrs**

Introduction to Motivation, Relevance and types of Motivation, Selected theories of motivation

Unit-V: Leadership **2 hrs**

Introduction to leadership, Leadership in administration. Qualities of a good leader. Swami Vivekananda great leader- selected lessons from his life.

Practical: **32 hrs**

1. Role playing (short speech, presentation etc.) **8 hrs**
2. Group discussion **8 hrs**
3. Assignments related to the course **8 hrs**
4. Seminar on the overview of the module at the end of the semester. **8 hrs**

Post-Harvest Management and Value Addition
Course Code- BVGE-502
Credit- 2+0+2 (Lecture+Tutorial+Practical)

Objectives:

The paper familiarizes the students on the -

- **a.** Study of scientific and technological advancements in post-harvesting and food processing;
- **b.** To provide knowledge and proficiency in preparation of value-added products;
- **c.** State proper post-harvest care can add value and provide benefit to the producers and consumers;
- **d.** Explain efficient post-harvest operation can generate employment and bring rural industrialization;
- **e.** Highlight the role of post-harvest technology for better economy of the country through export earnings.

Theory **32 hrs**

Unit-I: Introduction of Post-Harvest Technology **5 hrs**

Introduction to post-harvest technology of agricultural produce, Status of production, Losses, Need, Scope and Importance; Introduction to various post-harvest operations – Harvesting, Handling, Cleaning, Grading, Sorting, Drying, Storage, Milling, Size reduction, Expelling, Extraction, Blending, Heat treatment, Separation, Material handling (transportation, conveying, elevating),Washing& their functions and Use in the post-harvest processing.

Unit-II: Drying of Cereals and Pulses **5 hrs**

Drying – Definition, Importance, Characteristics, Principles & Factors affecting drying; Types of drying methods *viz*. Sun drying & Artificial drying by mechanical means – Psychometric Chart, Moisture content representation, equilibrium moisture content; Determination of moisture content by direct and indirect methods; Types of dryers – Deep bed dryers, Flat bed dryers, Continuous flow dryers, L.S.V. dryers, Spray dryer, Fluidized bed dryers, Rotary dryer, Spouted beds, Freeze dryer, Tray & Tunnel dryers.

Unit-III: Storage of Cereals and Pulses **5 hrs**

Storage – definition, need, importance & principles; Influence of moisture content, relative humidity, temperature, fungi, etc. on stored product; Infections associated with stored grains; Various types of storage structures – Deep & Shallow bins, Traditional & modem storage structures; Management of storage structures; Losses during storage and their control; Space requirement of bag storage structure; Types of Material conveying systems – Belt conveyor, Bucket elevator, Screw conveyor, Pneumatic conveyor, etc.

Unit-IV: Post-harvest Technology of Fruits and Vegetables **4 hrs**

Methods of Harvesting and Post-harvest losses in fruits and vegetables; Handling of Fruits and Vegetables; Storage of fruits and vegetables – Need, Importance & Principles; Recommended storage operation conditions for some important fruits and vegetables and their storage life; Post-harvest treatment to increase shelf life – Freezing, Chilling, Dehydration, Canning & Thermal processing; Packaging of fruits and vegetables; Types of packaging; Concept of modified

atmosphere packaging, Factors affecting post-harvest life of perishable horticultural produce, Zero energy cool chamber.

Unit-V: Classification of Food **4 hrs**

Definition of food, classification of foods- based on origin, pH, nutritive value, Food groups functions of food, Health food, functional food, indigenous food, importance and its nutritive value.

Unit-VI: Food Preservation **4 hrs**

Importance and scope of food preservation, Principles of preservation by heat, low temperature, chemicals and fermentation, Preservation through canning, bottling, freezing, dehydration, drying, ultraviolet and ionizing radiations.

Unit-VII: Processing of indigenous fruits and vegetables **5 hrs**

Preparation of jams, jellies, marmalades, candies, crystallized and glazed fruits, preserves, chutneys, pickles, ketchup, sauce, puree, syrups, juices, squashes and cordials.

Practical: **64 hrs**

1. Determination of physical properties of agricultural produce – Size, Shape, Density and Angle of repose of Cereals, Pulses and Oil Seeds, Change in Specific Gravity, TSS, Acid of Fruits and Vegetables.
2. Determination of moisture content of grains.
3. Study of different types of dryers.
4. Study of different grain storage structures.
5. Study of different packaging materials.
6. Study of zero energy cool chamber
7. Visit to warehouse, packhouse and cold storage.
8. Preparation of Ragi Powder, Ragi Laddoo and different dried medicinal herbs viz. neem, munga, tulsi, mint, giloy, etc.
9. Preparation of nutritive and medicinal bari.
10. Preparation of chips and papad.
11. Preparation of jams, jellies, marmalades, candies and chutneys.
12. Preparation of various types of pickles (oal pickle/ mango pickle/ mixed pickle).

Suggested Readings:

i. *Post-Harvest Technology of Cereal, Pulses & Oilseeds – A Chakraverty, Oxford & IBH Pub. Co.*
ii. *Unit Operation of Agro-processing Engineering – KM Sahay & KK Singh, Vikas Pub.*
iii. *Post-harvest Technology of Fruits & Vegetables – Thompson, CBS Pub. & Dis.*

Agri-Business Management
Course Code- BVGE-503
Credit- 2+0+2 (Lecture+Tutorial+Practical)

Objectives:

This paper helps the students to get acquainted with:

1. The introduction to agri-business management.
2. The knowledge to start agri-business ventures and relevant government policies.
3. The management procedures of different agro-based industries including financial, marketing, and supply chain management.

Theory **32 hrs**

Unit-I: Introduction to Agribusiness Management **7 hrs**

1. Agribusiness: Distinctive features of Agribusiness Management. The concept of farm/firm and industry. Need, opportunities, and challenges for developing agribusiness in India. resources of an enterprise, importance of various resources, scarcity of resources, utilization of resources.
2. Transformation of agriculture into agribusiness, Present Agricultural Policies.
3. Classification of industries and types of agro-based industries. New Classification of MSME.

Unit-II: Agribusiness Start-ups **8 hrs**

1. Setting up of agribusiness start-ups: Business opportunities in various sectors. Identification and selection of business opportunities. Business environment: PEST Analysis (political, economic, social, and technological) & Strength-Limitations-Opportunities-Challenges (SLOC) analysis.
2. Formulation of business plans: meaning of business plan. Formulation of business plans. Common errors in the formulation of business plans.

Unit-III: Management of Agribusiness **12 hrs**

1. Principles of management: Meaning and characteristics. Importance and scope of management. Functions of management. Management process. Principles of management.
2. Planning, meaning, definition, types of plans. Steps in planning and implementation.
3. Financial and Capital Management of Agribusiness: Sources of finance. Capital structure and capitalization. Venture capital. Financial statements and indicators of a farm. Kisan Credit Card (KCC).
4. Marketing Management: Segmentation, targeting & positioning. Marketing mix and marketing strategies. Consumer behaviour analysis, Product Life Cycle (PLC). Sales & Distribution Management. Pricing policy, various pricing methods.
5. Supply chain management: Meaning. Importance. Integrated agri-supply chain management. Supply chain networks, components.
   Agri-value chain: Understanding primary and support activities and their linkages.

Unit-IV: Project Management **5 hrs**

1. Definition, project cycle, identification, formulation, appraisal, implementation, monitoring and evaluation.

Practical **64 hrs**

1. Studies/Hands-on business training on input markets, output markets, product markets, retail trade, commodity trading, and value-added products. (Study of various agri-supply chains.)
2. Study of financing institutions-Cooperative, Commercial banks, RRBs, Agribusiness Finance Limited, NABARD.
3. Preparations of projects and Feasibility reports for agribusiness entrepreneurs.
4. Appraisal/evaluation techniques of identifying viable projects- Non-discounting and discounting techniques.
5. Case study of agro-based industries/start-ups.

Suggested Readings:

i. S. S. Khanka. Entrepreneurial development. S. Chand.

ii. Reddy, S.S., Ram, P. R., Sastry, T.V.N. and Devi, I.B. 2019. Agricultural Economics. Oxford and IBH Co. Pvt. Ltd., New Delhi.

Advanced Organic and Natural Farming
Course Code- BVSA-501
Credit- 2+0+2 (Lecture+Tutorial+Practical)

Theory **32 hrs**

UNIT-I: Biodynamic Agriculture **12 hrs**

Biodynamic Agriculture: Concept, definition, principles and its application. Agricultural activities as per the moon calendar, Biodynamic Preparations

Unit-II: Natural Farming **04 hrs**

Natural Farming: concept and definition, principles, advantages and constraints in natural farming. Common practices under Natural Farming: land preparation, Seed sowing, weed management, pest and disease management, irrigation method, mulching methods etc.

Unit-III: New Practices in Sustainable Agriculture **05 hrs**

Zero budget natural farming practices of Subhas Palekar, Amrut Krishi, Natueco Farming, Rishi Krishi, Homa Farming

Unit-IV: Organic Certification **12 hrs**

Third-party certification process (NPOP guidelines), Risk management in compliance with standards, Participatory guarantee system, Documentation in third party and PGS certification, Documents need for sale of organic produce, and traceability. Paramparagat Krishi Vikas Yojana (PKVY)

Practical **64 hrs**

1. Preparation of BD-500 or BD-501
2. Practice of biodynamic farming on major crop(s) and keeping their daily records
3. Preparation technique of Amrit Jal and Amrit Mitti
4. Preparation techniques of enriched composts- Enriched NADEP, Enriched Vermicompost etc.
5. Some selected practices of Natural farming- Zero Tillage, Live mulching, seed sowing technique, relay cropping

6. Some selected techniques of Zero Budget Natural Farming- mulching, neemastra, brahmastra, beejamrit, jivamrit etc.
7. Seminar/quiz/ Group Discussion on the related topics

Experiential Learning Programme (ELP)
Course Code- BVSA-502
Credit- 0+0+6 (Lecture+Tutorial+Practical)

Course Objectives

- ✓ *To familiarize with different professional trades of agriculture.*
- ✓ *To understand the feasibility of such trades through hands-on-training.*
- ✓ *To realize the economic viability of those trades.*
- ✓ *To develop skill in particular trade.*

This programme is necessary for hands on training and skill improvement of students. Each student will have to opt any one course of four credit among the courses being offered by the ARTD faculty centre. Students can take course as per their choice/ academic performance/decision of the committee. Existing infrastructural facilities of our faculty centre (in collaboration with the Divyayan KVK) can offer the following ten (10) Experiential Learning Programme (ELP):

1. Production Technology: Bioagents and Bio-fertilizer
2. Seed Production Technology
3. Mushroom Cultivation Technology
4. Poultry Production Technology
5. Floriculture and Landscaping
6. Commercial Beekeeping
7. Organic Production Technology
8. Tissue Culture Technologies
9. Food Processing
10. Beekeeping

Semester-VI

Course Code	Course Component	Course Title	Credit	Cumulative Credit
BVSA-601	Skill Component	Farm Machinery and Power	2+0+2	**78**
BVSA-602		Seed Production Technology	2+0+2	
BVEC-601		Innovative Project	0+0+2	
BVEC-602		Students Social Responsibilities (SSR)	0+0+2	
BVIAP-601		Industrial Attachment	0+0+10	
		Total credit in Semester-VI	**4+0+16=20**	**120**

Elective Courses: BVEC-601 or BVEC-602

Farm Machinery and Power
Course Code- BVSA-601
Credit- 2+0+2 (Lecture+Tutorial+Practical)

Objectives:

The paper familiarizes the students with the -

e) Basics and components of farm power and engines
f) Use of farm power and machinery in agriculture
g) Harvesting and utilization of Renewable Energy in Agriculture

Theory **32 hrs**

Unit-I: Introduction to Farm Power and Engines **4 hrs**

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

Unit-II: Components and Systems of Engines **10 hrs**

Study of different components of I.C. engine, I.C. engine terminology, Familiarization with different systems of I.C. engines: Air cleaning, cooling, lubrication, fuel supply and hydraulic control system of a tractor, Familiarization with Power transmission system: clutch, gear box, differential and final drive of a tractor, Tractor types

Unit-III: Use of Farm Power and Machinery in Agriculture Operations **10 hrs**

Familiarization with Primary and Secondary Tillage implements, Implement for hill agriculture, implement for intercultural operations, Familiarization with sowing and planting equipment, calibration of a seed drill, Familiarization with Plant Protection equipment, Familiarization with harvesting and threshing equipment.

Unit-IV: Design and Analysis of Renewable Energy Conversion Systems **8 hrs**

Energy cycle of the earth; Energy heat flow and energy storage; photosynthesis and biomass; renewable energy sources, Conversion of solar energy, wind energy, water flows, heat, biomass, etc.; other conversion processes. Use of renewable energy in agriculture, Design of bio-fuel production units

Practical: **64 hrs**

1. Study of different components of I.C. engine.
2. To study air cleaning and cooling system of engine.

3. Familiarization with clutch, transmission.
4. differential and final drive of a tractor.
5. Familiarization with lubrication and fuel supply system of engine.
6. Familiarization with brake, steering, hydraulic control system of engine.
7. Learning of tractor driving.
8. Familiarization with operation of power tiller.
9. Familiarization with implements for hill agriculture.
10. Familiarization with different types of primary and secondary tillage implements: mould plough, disc plough, rotavator, disc harrow etc.
11. Familiarization with seed-cum-fertilizer drills their seed metering mechanism and calibration.
12. Identification and working principles of planters and transplanter
13. Familiarization with different types of sprayers and dusters.
14. Familiarization with different intercultivation equipment.
15. Familiarization with harvesting and threshing machinery.
16. Familiarization with renewable energy gadgets.
17. To study biogas plants.
18. To study the production process of bio-fuels.
19. Familiarization with different solar energy gadgets.
20. To study solar photovoltaic systems: solar light, solar pumping, solar fencing.

Note- The syllabus is taken from the ICAR-recommended B.Sc. (Hons.) Agriculture

Suggested Readings:

7. Concepts of Farm Machinery and Power- Dipankar Mondal (Narendra Publishing House)
8. Principles of Agricultural Engineering-T.P. Ojha and A.M. Michael (Jain Brothers)
9. Elements of Agricultural Engineering-Jagadishwar Sahay (Standard Publishers Distributors)
10. Farm Machinery Design-Principles and Problems-D.N. Sharma and Mukesh Jain (Jain Brothers)
11. Renewable Energy- Sanjay Kumar (Kalyani Publishers)

Seed Production Technology
Course Code- BVSA-602
Credit- 2+0+2 (Lecture+Tutorial+Practical)

Objective:

1. To impart the skills of genetically pure seed production of important crops of Jharkhand

Theory **32 hrs**

Module I: Definition of seed, development of seed, definition of variety 2 hrs

Module II: General principles of seed production of genetically pure and otherwise good quality seeds of self, cross and often cross-pollinated crops. 6 hrs

Module III: Concept of Nucleus seed, Breeder Seed, Foundation seed, Certified seed and Truthfully labelled seeds, Seed certification. 8 hrs

Module IV: Maintenance of genetic purity during seed production, off types, roughing, isolation distance. 6 hrs

Module V: Production of hybrid seeds, A-line, B-line, and R-line, the concept of double cross hybrids, synthetics and composites. 8 hrs

Module VI: Seed Processing, Seed testing, Seed drying, seed treatment, storage, and marketing. 2 hrs

Practical **64 hrs**

1. Identification of different crops and varieties. 8 hr
2. Seed treatment 1 hr
3. DUS testing for major crops. 4 hrs
4. Seed germination /Viability test. 8 hrs
5. Physical purity test and grading techniques. 8 hrs
6. Estimation of moisture content at harvest / different stages. 4 hrs
7. Visit of seed production plots (farmers, SSC, NSC) 8 hrs
8. Identification of off types rouging. 4 hrs
9. Identification of Nucleus, Breeder, Foundation, Certified, and Truthfully labeled seeds. 15 hrs
10. Visit of seed processing units. 4 hrs

Suggested Readings:

i. *R.L Agarwal: Seed Technology, Oxford and IBH Publications Pvt. Ltd. New Delhi.*

ii. *D. Khare and M. S. Bhale* , Seed Technology Scientific Publication (India).

Industrial Attachment
Course Code- BVIAP-601
Credit- 0+0+10 (Lecture+Tutorial+Practical)

The Industrial attachment will be of 2-month duration. Students will be sent to different industries working in the field of agriculture, and allied sectors. They will get exposure to learn from industries through hands-on training.

Semester-VII

Course Code	Course Component	Course Title	Credit	Cumulative Credit
BVGE-701	General Education	Elementary Statistics	1+0+1	**52**
BVGE-702		Human Resource Management	2+0+2	
BVGE-703		Transfer of Technology	0+0+4	
BVSA-701	Skill Component	Basic Accounting and Book-keeping	2+0+2	**88**
BVSA-702		ICT in Agriculture and MIS	1+0+1	
BVSA-703		Rural Living	0+0+4	
		Total credit in Semester VII	**6+0+14=20**	**140**

Elementary Statistics
Course Code- BVGE-701
Credit- 1+0+1 (Lecture+Tutorial+Practical)

Theory **16 hrs**

Unit-I: Introduction to Statistics **2 hrs**

Meaning of statistics, aims of statistics, definition and limitations, need and scope. Graphical and tabular representation of data.Simple and grouped frequency distribution of data. Tally mark and counting.

Unit-II: Descriptive Statistics **4 hrs**

Measures of Central Tendency: Calculation of mean, median and mode. Measures of Dispersion: range, standard deviation and coefficient of variation. Measures of Skewness: Karl Pearson's and Bowley's Coefficient of skewness. Measures of Kurtosis: Platykurtic, Mesokurtic and Leptokurtic graphs.

Unit-III: Measures of Correlation and Regression **4 hrs**

Definition of Correlation, Scatter Diagram. Karl Pearson's Coefficient of Correlation. Linear Regression Equations. Properties of Regression coefficients.

Unit-IV: Design of Field experiments **6 hrs**

Basics of Experimental design. Introduction to Analysis of Variance, Analysis of One-Way Classification. Types of experimental designs viz. Completely Randomized Design (CRD), Randomized Block Design (RBD).

Practical: **32 hrs**

1)Graphical Representation of Data.

2) Calculation and tabulation of frequency.

3)Measures of Central Tendency (Ungrouped data)

4)Measures of Dispersion (Ungrouped Data).Measures of Dispersion (Grouped Data).

5)Moments, Measures of Skewness & Kurtosis (Ungrouped Data).

6) Correlation & Regression Analysis.

7) Data analysis using experimental designs (CRD and RBD) for agricultural research.

Suggested Readings:

1. Research Methodology: Methods and Techniques" by C.R. Kothari
2. "Agriculture and Applied Statistics Vol-I" by P.K. Sahu.
3. "Agriculture and Applied Statistics Vol-II" by P.K. Sahu and A.K. Das
4. "Research Methodology: A Guide for Researchers in Agricultural Science, Social Science and Other Related Fields" by Pradip Kumar Sahu.

BVGE- 702: Human Resource Management
Credit-2+0+2 (Lecture+Tutorial+Practical)

Objectives: To give a conceptual understanding of human resource practices in organizations. Learning Outcome: On completing the course students will be able to: 1. Understand and develop insights and knowledge base of various concepts and Functions of Human Resource Management 2. Learn the latest trends in Human Resource Management.

UNIT I: Management **10 Hrs.**

Management – concept, objectives, and importance. Management functions-planning, organizing, staffing, directing and controlling, Principles of Management –principles of management developed by Fayol and Taylor's Scientific management – principles and techniques. Motivation – concept, Maslow's hierarchy of needs, Financial and non-financial incentives. Leadership – concept, styles – authoritative, democratic and laissez-faire. Introduction to Human Resource Management: Meaning, definition, importance, scope, and objectives of HRM. Personal management vs. Human Resource Management; HRM and competitive advantage. HR department- organizational composition, role, functions.

UNIT II: Human Resource Management **8Hrs.**

Procurement of HR: Meaning and Importance of HR planning; Job analysis---process of job analysis, job description, job specification, methods of job analysis,
Job design. Recruitment – concept, sources of recruitment, merits, and demerits of internal and external sources of recruitment. Selection – concept, process, meaning of selection, Barriers to the selection process. Difference between recruitment and selection.

UNIT III: Training and Development **6 Hrs.**

Training and Development: Concepts; importance; Training and development methods of training – on-the-job and off-the-job methods – Apprenticeship, vestibule training, case study, role-playing, sensitivity training, Methods vestibule training, apprenticeship training, and internship training. Differentiate between training and development.

UNIT IV: Performance Appraisal, and Compensation **8 Hrs.**

Performance Appraisal, and Compensation: Performance appraisal -need and Importance, objectives, process and methods, Challenges and Legal issues in performance appraisal, Performance Appraisal, and Competitive Advantage, The Philips Model of potential appraisal. Compensation- concept, objective, and philosophy of compensation, factors Influencing Employee Compensation, different components of employee compensation, Importance of an ideal compensation system, devising a compensation Plan.

Practical: **64 Hrs**

1. Relevant case studies on the above topics.
2. Study of Human Resources Outsourcing and fractional HR for Entrepreneurial Ventures.
3. Study the impact of artificial intelligence on human resources and human resource management.

Reference Books:

1. Dessler, Human Resource Management, Prentice Hall of India.
2. D. A. DeCenzo and S. P. Robbins, S. L Verhulust, Human Resource Management, Wiley.
3. GrayDesler, Biju Varkkey, Human Resource Management,Pearson Education.
4. K. Aswathappa, Human Resource Management Text and Cases, McGraw Hill Education.
5. VSP Rao, Human Resource Management, Excel Books.

BVGE- 703: Transfer of Technology
Credit-0+0+4 (Lecture+Tutorial+Practical)

Objectives: The main objective of this course is to enable the students to give back to the society. They will stay at villages and transfer their technological knowledge to the farmers. This will also learn innovation – diffusion process of an agricultural innovation. They will also adopt the skills to work with the farmers at the actual field which is beyond the classroom learning. In this course the students will demonstrate the package of technologies on the major crops/vegetables/ fruits/animals/birds etc.

BVSA- 701: Basic Accounting and Book-keeping
Credit-2+0+2 (Lecture+Tutorial+Practical)

Objectives: The main objective of this course is to enable the students to understand the fundamental principles of accounting and to develop skills in preparing, maintaining, and analysing books of accounts.

UNIT-I: Introduction to Accounting **8 Hrs.**

Need for Accounting, Meaning, Objectives and Advantages of Accounting, Accounting as source information, Internal and External users of accounting information and their needs, Accounting process. Branches of Accounting and book-keeping. The difference among Book-keeping, Accounting, and Accountancy. Basic Accounting Terms –Asset, Liability, Capital, Expense, Income, Expenditure, Revenue, Debtors, Creditors, Goods, Cost, Gain, Stock, Purchase, Sales, Loss, Profit, Voucher, Discount, Transaction, Drawings.

UNIT-II: Theory Base of Accounting **8 Hrs.**

Basic accounting assumptions, basic accounting principles The modifying accounting principles, Accounting Standards – Concept and List of Indian Accounting Standards. Accounting Mechanism – Single Entry and Double Entry. Accounting Equation-Meaning and Computation of Accounting Equation

UNIT-III: Basic Accounting Procedures **8 Hrs.**

Journal, Ledger, and Trial Balance. The source document, Meaning of Journal, Ledger and Trial Balance. Steps in Journalising, advantages of Journal, Utility of Ledger. Objectives and methods of preparing Trial Balance, Limitations of Trial Balance.

UNIT-IV: Financial statements **8 Hrs.**

Trading Account, Profit and Loss Account, and Balance Sheet. Capital expenditure and Revenue Expenditure. Distinction between Capital expenditure and Revenue Expenditure. Meaning and need of Trading Account, Profit and Loss Account, and Balance Sheet. Difference between Trial Balance and Balance Sheet. Arrangement and classification of Assets and Liabilities. Needs for adjustments and items of adjustments in financial statements.

Practical **64 Hrs.**

1. Journalising the transactions in the books of Accounts.
2. Preparation of Ledger Accounts and Trial Balance.
3. Preparation of Financial statements: Trading Account, Profit and loss Account, and Balance Sheet with and without adjustments.

ICT in Agriculture and MIS
Course Code- BVSA-702
Credit- 1+0+1 (Lecture+Tutorial+Practical)

Theory **16 hrs**

Unit-I: Introduction to Computer Application and ICT: **6 hrs**

Introduction to Computers, Computer Hardware and External Peripherals. Computer Software and Programming Languages, Computer Networking and Internet Technology, World Wide Web (WWW): Concepts and Components Use of Ms-word, Ms – Excel and Ms PowerPoint. ICT: Definition and meaning of information, information as a strategic resource, changing conceptions of information and information systems, search processes and data retrieval using search engines, downloading, uploading.

Unit-II: Role of ICT in Agriculture **4 hrs**

Concept, need, limitation and prospect of ICT in Agriculture. ICT tools- electronic media, telephone call, email, usage of multimedia, mobile App, video and teleconferencing, computer assisted instruction. E-soil health card programme. ICT in agri-marketing- eNam.

Unit-III: Management Information System: **6 hrs**

Concept of MIS – Definition, importance, prerequisites, advantages and challenges; Information Needs of organization, IS and Decision – Making. Types/Classification of Information System for organizations – Office Automation Systems, Transaction Processing Systems, Decision Support System, Executive Support System, Knowledge Based Expert System.

Practical: **32 hrs**

1. 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.
2. Visit to MIS / WEB portal of different government schemes/programme: MGNREGS, Swalekh etc.
3. Development of blog.
4. Feeding data into MIS/web portal.
5. Execution of Video Conference.

Suggested Readings:

1. "Computer Fundamentals" by P.K. Sinha
2. "Computer Awareness" by Arihant Experts
3. Management Information Systems" by James O'Brien
4. Management Information Systems: Text & Cases" by Waman S. Jawadekar

BVSA- 703: Rural Living
Credit-0+0+4 (Lecture+Tutorial+Practical)

Objectives: The students will follow the guidelines of Rural Living and Learning Experience (RLLE) of the ARTD programme.

Semester-VIII with research

Course Code	Course Component	Course Title	Credit	Cumulative Credit
BVRC-801	General Education	Research Methodology	2+0+1	**60**
BVRC-802		Proposed Plan of Research Work (PPRW)	0+0+2	
BVRC-803		Research Publication Ethics and Review of Literature	2+0+1	
BVRC-804	Skill Component	Agricultural Research-Oriented Project Work	0+0+12	**100**
		Total credit in Semester-VIII	**4+0+16=20**	**160**

Research Methodology
Course Code- BVRC-801
Credit- 2+0+1 (Lecture+Tutorial+Practical)

Theory **32 hrs**

Unit-I: Research Methodology: An Introduction. **8 hrs**

Meaning and objectives of research. Types of Research, Research Methods versus Methodology, Research Process, Criteria of Good Research methods.Various important concepts in research methodology: Population and sample, census vs sample survey, sampling techniques: random and non-random sampling etc., Steps for conducting a research.

Unit II: Tools and Techniques of Data Collection **10 hrs**

Difference between primary and secondary data, Observation – Components, Types, Factors, Controlled and Non-Controlled method, Participant and Non-Participant. Interview- Types, Merits and Demerits, Schedule - Types, Merits and Demerits, Questionnaire - Types, Merits and Demerits, Case studies - Types, Merits and Demerits, Focused Group discussion.

Unit III: Statistical Techniques for Rural Research **10 hrs**

Meaning of statistics, aims of statistics, definition and limitations, need and scope. Measurement – Nominal, Ordinal and Internal scale of measurement. Tables – textual, semi tabular, construction of frequency distribution tables for discrete and continuous variables. Graphical representation of data – bar diagram, histogram etc. Measures of Central tendency – mean, median, mode. Test of Hypothesis – Parametric tests: t- test, Z- test, F-test, Test of Significance.

Unit IV: Interpretation and report writing **4 hrs**

Meaning of Interpretation. Why Interpretation? Technique of Interpretation: Precaution in Interpretation. Significance of Report Writing. Different Steps in Writing Report.

Practical: **32 hrs**

1. Data entry, tabulation, and graphical representation of data
2. Analysis and interpretation of data using MS Excel.
3. Test of significance: t-test, F-test and z-test.
4. Socio-economic data collection in a village.
5. Writing a statistical analytical report.

Suggested Readings:

1. Research Methodology: Methods and Techniques" by C.R. Kothari
2. "Research Methodology: A Step-by-Step Guide for Beginners" by Ranjit Kumar
3. "Research Methodology: A Step-by-Step Guide for Beginners" by Dr. A. G. Ghodke and Dr. R. M. Sathe
4. "Research Methodology: A Guide for Researchers in Agricultural Science, Social Science and Other Related Fields" by Pradip Kumar Sahu

Proposed Plan of Research Work (PPRW)
Course Code- BVRC-802
Credit- 0+0+2 (Lecture+Tutorial+Practical)

Practical **64 hrs**

- ✓ Students obtaining atleast 75% or 7.5 OGPA till 6th Semester will be eligible to uptake this course.
- ✓ A faculty will be assigned to the student as per their choice of the field of research work. The faculty will act as the 'Supervisor' of the concerned student for the research work.
- ✓ The evaluation of this course will be conducted in two ways (equal weightage to both):
  - i. The students have to prepare and submit a report on the proposed research topic on consulting with his/her supervisor.
  - ii. He/she also has to present a seminar in front of a board of experts.
- ✓ Only after passing this course the student will be allowed to carry forward his research work. Students failed to pass this course will have to again repeat the above-mentioned both procedures.

Research and Publication Ethics, and Review of Literature
Course Code- BVRC-803
Credit- 2+0+1 (Lecture+Tutorial+Practical)

Theory **32 hrs**

Unit I: Research Ethics **8 hrs**

Introduction to research ethics and responsible conduct of research, Ethical principles (e.g., respect for participants, beneficence, justice), Institutional review boards (IRBs) and ethical approval processes, Ethical dilemmas and issues in research

Unit II: Ethical Considerations in Research **8 hrs**

Informed consent and confidentiality in research, Integrity in data collection, analysis, and reporting, Plagiarism, authorship, and publication ethics, Ethical considerations in interdisciplinary research.

Unit III: Publication ethics **12 hrs**

Publication ethics: definition, introduction and importance, COP, Best practices/standards setting initiatives and guidelines: COPE, Publication misconduct: Definition, concept, problems that lead to unethical behavior, types, Violation of publication ethics, authorship and contributorship, Identification of publication misconduct

Unit IV: References in Research Writing **4 hrs**

Concept of references, bibliography, Reference management, Process and guidelines of writing reference.

Practical: **32 hrs**

1. Hand-on-practice of Literature Review and referencing techniques **16 hrs**
2. Identification of Peer-reviewed journals, books **8 hrs**
3. Citation management tools (Zotero, Mendeley etc.) **8 hrs**

Suggested Readings:

1. Ethics in Research by John Scott, SAGE Publications India Pvt Ltd

2. Systematic Approaches to a Successful Literature Review- by Andrew Booth, Anthea Sutton, Diana Papaioannou, SAGE Publications Ltd

3. Writing Literature Reviews: A Guide for Students of the Social and Behavioral Sciences- by Jose L. Galvan, Routledge

4. Scientific Writing and Communication: Papers, Proposals, and Presentations- by Angelika H. Hofmann, Oxford University Press

Agricultural Research-Oriented Project Work
Course Code- BVRC-804
Credit- 0+0+12 (Lecture+Tutorial+Practical)

Students will be oriented with basic research activities in the field of agriculture and allied sector and they will also learn to write research outcomes.

Semester-VIII without research

Course Code	Course Component	Course Title	Credit	Cumulative Credit
BVIAP-801	Industrial Attachment	Apprenticeship	0+0+20	108
		Total credit in Semester-VIII	**20**	**160**