Bachelor of Vocation (B. Voc.) in Agriculture
Course Content

Semester-I

A. General Education (Core Papers)

Paper Title: Communicative English
Paper Code: BVAG-101
Credit: 4
Maximum Marks: 100

Course Outcomes (COs)/Learning Outcomes
The knowledge and skill that the student acquire at the end of each course/paper:
At the end of the course the students will be able to acquire knowledge and/or perform:

CO1	The importance of the correct use of the English language in business communication.
CO2	Becoming a good listeners by giving listening skills for effective communication.
CO3	Acquire the proper speaking skills needed for interactive form of communication.
CO4	Gain the art of writing skill for effective communication which is the key to the success of each and every career oriented course.
CO5	Write business communication letters for effective business communication.

Unit 1:
Language: Principles of correct uses of languages -words, sentences, paragraphs, continuity and flow. Pronunciation: Phonemic symbols-consonants-vowels-syllabus-word stress-strong and weak forms-intonation. Dialogue Practice - sample practice in dialogue, using core and supplementary materials.
Unit 2:
Listening skills: Difference between listening and hearing- active listening- barriers to listening-Academic listening-listening for details-listening and note-taking-listening for sound contents videos-listening to talks and descriptions-listening for meaning-listening to announcements-listening to news programmes.
Unit 3:
Speaking skills: Interactive nature of communication-importance of context-formal and informal-set expression in different situations-greeting-introduction-making request —asking for/giving permission-giving instructions and directions-agreeing/disagreeing-seeking and giving advice-inviting and apologizing, telephone skills-conversational manners.
Unit 4:
Writing Skills: mechanism of writing-words and sentences-paragraph as a unit of structuring a whole text-combining different sources-functional use of writing-personal-creative use of writing. Writing models-essay-précis-expansion of ideas-letter writing-personal letters-formal letters-CV-surveys-questionnaire-e mail-fax-job application, reports.
Reference books:
1. Marks J. English pronunciation in use. New Delhi: CUP, 2007.
2. Lynch, T. Studing listening, New Deilhi:P CUP, 2008.
3. Kenneth, Anderson, Lynch T. MacLean J., Study Speaking, New Delhi: CUP, 2008.
4. Raman, M & Sharma, S. Communicative English, Oxford University Press,
5. Sharma, R. C, Business Correspondence and Report Writing.

Paper Title:Consumer Affairs
Paper Code: BVAG-102
Credit: 4
Maximum Marks: 100

Course Outcomes (COs)/Learning Outcomes
The knowledge and skill that the student acquire at the end of each course/paper:
At the end of the course the students will be able to acquire knowledge and/or perform:

CO1	The conceptual framework and of Consumer and Nature of markets.
CO2	Explain the Consumer Protection Law in India, Organizational set-up under the Consumer Protection Act.
CO3	Understand the Grievance redressed Mechanism under the Indian Consumer Protection Law.
CO4	Identify the Role of Industry Regulators in Consumer Protection.
CO5	Discuss about the Contemporary Issues in Consumer Affairs.

Unit-I:
Conceptual Framework
Consumer and Markets: Concept of Consumer, Nature of markets:Liberalization and GlobalizationofmarketswithspecialreferencetoIndianConsumerMarkets,E-Commercewith reference to Indian Market, Concept of Price in Retail and Wholesale, Maximum Retail Price (MRP),FairPrice,GST,labellingandpackagingalongwithrelevantlaws,LegalMetrology.
Experiencing and Voicing Dissatisfaction: Consumer buying process, Consumer Satisfaction/dissatisfaction-Grievances-complaint, Consumer Complaining Behaviour: AlternativesavailabletoDissatisfiedConsumers;ComplaintHandlingProcess:ISO10000suit.
Unit-II:
The Consumer Protection Law in India: ***ObjectivesandBasicConcepts:***ConsumerrightsandUNGuidelinesonconsumerprotection, Consumer goods, defect in goods, spurious goods and services, service, deficiency inservice, unfair trade practice, restrictive tradepractice. ***Organizational set-up under the Consumer Protection Act:*** *Advisory Bodies*: Consumer Protection Councils at the Central, State and District Levels; Adjudicatory Bodies: District Forums,StateCommissions,NationalCommission;RoleofSupremeCourtundertheCPAwith important caselaw. ***GrievanceRedressalMechanismundertheIndianConsumerProtectionLaw:*** Whocanfile acomplaint?Groundsoffilingacomplaint;Limitationperiod;Procedureforfilingandhearing of a complaint; Disposal of cases, Relief/Remedy available; Temporary Injunction, Enforcementoforder,Appeal,frivolousandvexatiouscomplaints;Offencesandpenalties.
Unit-III:
Role of Industry Regulators in Consumer Protection ***Banking***: RBI and Banking Ombudsman; ***Insurance***: IRDA and Insurance Ombudsman; ***Telecommunication***:TRAI;***FoodProducts***:FSSAI;***ElectricitySupply***:ElectricityRegulatory Commission; ***Real State***: Real Estate RegulatoryAuthority
Unit-IV:
Contemporary Issues in Consumer Affair***Consumer Movement in India*:** Evolution of Consumer Movement in India, Formation of consumerorganizationsandtheirroleinconsumerprotection,MisleadingAdvertisementsand sustainableconsumption, NationalConsumerHelpline, Comparative Product testing, Sustainable consumption and energyratings.***Quality and Standardization*:** Voluntary and Mandatory standards; Role of BIS, Indian Standards Mark (ISI), Ag-mark, Hallmarking, Licensing and Surveillance; Role of International: ISO an Overview

Note: Unit II refers to the Consumer Protection Act, 1986. Any change in law would be added appropriately after the new law is notified.

Reference books:

1. Khanna, Sri Ram, SavitaHanspal, SheetalKapoor, and H.K. Awasthi. (2007). ConsumerAffairs, Universities Press.
2. Choudhary, Ram Naresh Prasad (2005). Consumer Protection Law Provisions andProcedure, Deep and Deep Publications Pvt Ltd.
3. G. Ganesan and M. Sumathy. (2012). Globalisation and Consumerism: Issues and Challenges, RegalPublications.
4. Suresh Misra and SapnaChadah (2012). Consumer Protection in India: Issues and Concerns, IIPA, NewDelhi
5. RajyalaxmiRao (2012), Consumer is King, Universal Law PublishingCompany
6. Girimaji, Pushpa (2002). Consumer Right for Everyone PenguinBooks.
7. E-books:-www.consumereducation.in
8. Empowering Consumerse-book,
9. e-book,www.consumeraffairs.nic.in

B. Ability Enhancement Paper: {BVAG-103A & BVAG-103A(P)/ BVAG-103B & BVAG-103B(P) / BVAG-103C & BVAG-103C(P)}

Paper Title: Fundamentals of Floriculture
Paper Code: BVAG-103A
Credit: 2
Maximum Marks: 50

Course Outcomes (COs)/Learning Outcomes

The knowledge and skill that the student acquire at the end of each course/paper:
At the end of the course the students will be able to acquire knowledge and/or perform:

CO1	Planning of a floriculture farm
CO2	Identification of important indigenous and exotic flowers of commercial value
CO3	Commercial production of various flowers for floriculture business
CO4	Knowledge of growing techniques for growing high value flowers in protected structures
CO5	Preparation of floriculture produces for marketing

Unit 1:

Scope and importance of commercial floriculture in India and Manipur. Indigenous and exotic commercially important flowers of Manipur-common and scientific names, uses (aesthetic, ornamental, medicinal and religious). Products specific intensive floriculture zones in India.

Unit 2:

Production techniques of commercial flower crops like rose, marigold, chrysanthemum, orchid, carnation, gladiolus, jasmine, crossandra, anthurium, dahlia, tuberose, bird of paradise, china aster and gerbera.

Unit 3:

Production techniques of high value flowers and foliage filler materials, growing of flowers under protected structures such as polyhouse, shadehouse, etc.

Unit 4:

Postharvest technology of cut flowers in respect of commercial flower crops, dehydration technique for drying of flowers, production techniques for bulbous.

Reference books:

1. A.K.Singh.2006. Flower crops, cultivation andmanagement. New India publishing agency, Pitampura, New Delhi.

2. T.K. Bose, L.P. Yadav, P. Patil, P. Das and V.A. ParthaSarthy. 2003. Commercial Flowers. ParthaSankarBasu, Nayaudyog, 206, BidhanSarani, Kolkata.
3. S.K. Bhattacharjee and L.C. De. 2003. Advanced Commercial Floriculture. AavishkarPublishers,Distributors, Jaipur.
4. DewasishChoudhary and Amal Mehta. 2010. Flower crops cultivation and management.
Oxford book company Jaipur, India. Randhawa,
5. G.S. AmitabhaMukhopadhyay, 2004. Floriculture in India. Allied Publishers Pvt. Ltd.
6. Arora, J.S. 2006. Introductory Ornamental Horticulture. Kalyani Publishers, Ludhiana.
7. Bhattacharjee, S.K. Advanced Commercial Floriculture. Aavishkar Publishers Distributors, Jaipur.
8. Sheela, V.L. 2008. Flower for trade. New India Publishing Agency, Pitampura, New Delhi-110088.
9. Abhinov Kumar. 2000. Production Technology of Ornamental Crops, Medicinal plants and Landscaping. Kalyani Publishers, New Delhi.

Paper Title: Fundamentals of Floriculture-Practical
Paper Code: BVAG-103A(P)
Credit: 2
Maximum Marks: 50

1. Identification of commercially important floricultural crops.
2. Propagation practices in chrysanthemum, sowing of seeds and raising of seedlings of annuals.
3. Propagation by cutting, layering, budding and grafting.
4. Pruning of roses and chrysanthemum, etc.
5. Use of chemicals and other compounds for prolonging the vase life of cut flowers.
6. Drying and preservation of flowers.
7. Flower arrangement practices.
8. Field visit and field training.

Paper Title: 2. Production Technology for Vegetable Crops
Paper Code: BVAG-103B
Credit: 2
Max. Marks: 50

Course Outcomes (COs)/Learning Outcomes
The knowledge and skill that the student acquire at the end of each course/paper:
At the end of the course the students will be able to acquire knowledge and/or perform:

CO1	Planning of a vegetable farm
CO2	Identification of important vegetable crops of commercial value
CO3	Knowledge of production technology of commercial vegetable crops
CO4	Management of a vegetable farm
CO5	Preparation of vegetable produces for marketing

Unit-I:
Brief account on origin, area, production, improved varieties and cultivation practices of- tomato, brinjal, chillies and okra.
Unit-II:
Brief account on origin, area, production, improved varieties and cultivation practices of Cucurbitaceous vegetables- cucumber, ridge gourd, bottle gourd, bitter gourd and melons.
Unit-III:
Brief account on origin, area, production, improved varieties and cultivationpractices of Cole crops of cabbage, cauliflower and knol–khol.
Unit-IV:
Brief account on origin, area, production, improved varieties and cultivation practices of bulb, tuber and root crops – onion, garlic, potato, sweet potato, carrot and radish.

Reference books:
1. Thamburaj, S. 2014. Text book of vegetable, tuber crops and spices. ICAR, New Delhi.
2. Choudhary, B.R. 2009. A text book on production technology of vegetables. Kalyani Publishers, Ludhiana.
3. Bose T.K. 2002. Vegetable crops. Nayaprakash. Kolkata.
4. Hazra, P. 2011. Modern technology in vegetable production. New India Publishing Agency. New Delhi.
5. Gopal Krishnan, T.R. 2007. Vegetable Crops. New India Publishing Agency. New Delhi.

Title: Production Technology of Vegetable Crops-Practical
Paper Code: BVAG-103B(P)
Credit: 2
Maximum Marks: 50

1. Identification of vegetables crops and the ir seeds.
2. Nursery raising of vegetables, direct seed sowing and transplanting.
3. Study of morphological characters of different vegetables.
4. Methods of Fertilizers applications.
5. Seed extraction of tomato and brinjal.
6. Harvesting & preparation for market.
7. Economics of vegetables cultivation.
8. Insect pest management of vegetable crops
9. Visit to commercial vegetable farms and field training

Title: Bio-fertilizer Technology
Paper Code: BVAG-103C
Credit: 2
Maximum Marks: 50

Course Outcomes (COs)/Learning Outcomes
The knowledge and skill that the student acquire at the end of each course/paper:
At the end of the course the students will be able to acquire knowledge and/or perform:

CO1	Basic knowledge of bio-fertilizer, types and classification
CO2	Identification and selection of various microorganisms used as bio-fertilizers
CO3	Knowledge of biochemistry of biological nitrogen fixation
CO4	Techniques for mass production of bio-fertilizer inoculants
CO5	Packaging, quality control and registration of bio-fertilizer products

Unit-I:
Introduction and types and importance of bio-fertilizers in agriculture and organic farming system; History of bio-fertilizers production; Classification of bio-fertilizers microorganisms used in bio-fertilizers production.
Unit-II:
Classification of biological nitrogen fixation; factors influencing nitrogen fixation; process of nodule formation, role of Nif and Nod gene in BNF; enzyme nitrogenase and its component; biochemistry of nitrogen fixation, methods used for the studying selection of efficient strain of *Rhizobium*.
Unit-III:
Mycorrhizae:type, host-endophyte interactions and contribution in nutrient uptake. Microbialinoculants preparation of rhizobial, blue-green algal and *Azolla* inoculants; their uses in improving soil fertility.

Unit IV:
Quality standard for bio-fertilizers; different methods of application of bio-fertilizers, methods of quality control assessment in respect of bio-fertilizers; strategies of mass multiplication and packing; registration of bio-fertilizers.

References books:
1. Alexander M. 1977. Soil Microbiology. John Wiley.
2. SubbaRao, N.S. Biofertilizers in Agriculture and Forestry. 1993. Oxford and IBH. Publ. Co., New Delhi.
3. Pepper HJ and Perlman D. 1979. Microbial Technology. 2nd Ed. Academic Press.
4. A century of Nitrogen Fixation Research Present status and Future propects. 1987. F.J. Bergersen and J.R. Postgate The Royal Soc., London.
5. Biology and Biochemistry of Nitrogen fixation. 1991. M.J. Dilworth,and A.R. Glenn, Elsevier, Amsterdam. .
6. Nitrogen Fixation in plants. 1986. R.O.D. Dixon,and C.T. Wheeler, Blackie USA, Chapman and Hall, New York.
7. A treatise on dinitrogen Fixation Section IV. Agronomy and Ecology 1977. R.W.F Hardy, and A.H. Gibson John Wiley & Sons, New York..
8. Symbiotic nitrogen fixation in plants, 1976. P.S. Nutman, Cambridge Univ. Press, London.
9. Bio-fertilizers in Agriculture and Forestry 1993. N.S. SubbaRao Oxford and IBH Publ. Co., New Delhi.

Title: Bio-fertilizer Technology-Practical
Paper Code: BVAG-103C(P)
Credit: 2
Maximum Marks: 50

1. Familiarization of equipment, machinery and tools used for bio-fertilizers production.
2. Media used for bio-fertilizers production.
3. Isolation of *BGA, PSB*, sulphur oxidizing microorganisms by dilution pour plate technique and enrichment culture technique.
4. Mass multiplication of BGA and *Azolla* and its application in paddy field.
5. Methods of application of bio-fertilizers.
6. Quality control of bio-fertilizers: ISI standards specified and estimating the viable bacterial count in carrier based bio-fertilizers.
7. Visits to commercial bio-fertilizer production units and KrishiSeva Kendra.

C. Skill Component Papers: Discipline Specific Papers

Paper Title: Fundamentals of Agronomy
Paper Code: BVAG-104
Credit: 4
Maximum Marks: 100

Course Outcomes (COs)/Learning Outcomes
The knowledge and skill that the student acquire at the end of each course/paper:
At the end of the course the students will be able to acquire knowledge and/or perform:

CO1	Knowledge of importance and relevance of crop production in Manipur and in India
CO2	Identification and classification of agricultural crops.
CO3	Knowledge of nutrient management for crop production
CO4	Identification of water resources and irrigation methods

CO5	Weed management in crop production

Unit-I:
Importance of agriculture in India and North East India, hunger and food security, sustainable agriculture, subsistence agriculture, natural farming, organic agriculture, commercial agriculture, extensive and intensive agriculture, precision agriculture peasant farming, urban agriculture, agricultural seasons in India and Manipur.
Unit-II:
Agricultural classification of crops, Agronomic classification of crops, Botanical classification of crops, Major farming systems in Manipur and Cropping Intensity, Methods of sowing/planting - planting geometry and its effect on growth and yield.
Unit-III:
Soil and climatic requirements, fertilizers and fertilizer use, management of fertilizers. Biological nitrogen fixation, green manure crops and cover crops. Integrated nutrient management. Weeds- importance, classification, crop weed competition, concepts of weed managementprinciples and methods, herbicides- classification, selectivity and resistance, allelopathy.
Unit-IV:
Irrigation: definition and objectives. Role of water in soil and plants- irrigated agriculture vs. rainfed agriculture, dry farming and dryland farming-definition. Water resources in India. Irrigation methods - drip and sprinkle irrigation systems. Water management of different cereal, pulse and vegetable crops.

Reference books:
1. Gopal Chandra De. Fundamentals of Agronomy. Oxford & IBH Publishers.
2. S.R. Reddy. Principles of Agronomy. Kalyani Publishers.
3. S.R. Reddy. Fundamentals of Agronomy. Kalyani Publishers.
4. Mukund Joshi. New Vistas of Organic Farming. Scientific Publishers.
5. S.S. Walia and U.S. Walia. Farming System and Sustainable Agriculture. Scientific Publishers.

Paper Title: Fundamentals of Agronomy-Practical
Paper Code: BVAG-104(P)
Credit: 2
Maximum Marks: 50

1. Identification of cereals and millets, pulses and oilseed crops.
2. Different methods of sowing; direct seeding: broadcasting, dibbling and drilling-transplantation.
3. Seed treatment - Rhizobium inoculation of leguminous crops.
4. Identification of manures -organic manures: bulky and concentrated manures Fertilizers:Straight, complex and mixed fertilizers - identification and preparation.
5. Fertilizer recommendation and calculation for major cereals and pulses.
6. Familiarization with green manure crops and cover crops.
7. Practice of methods of fertilizer applications- broadcasting, placement, foliar application and fertigation.
8. Field training in experimental farms.

Paper Code: BVAG-105
Paper Title: Fundamentals of Horticulture
Credit: 4
Maximum Marks: 100

Course Outcomes (COs)/Learning Outcomes
The knowledge and skill that the student acquire at the end of each course/paper:
At the end of the course the students will be able to acquire knowledge and/or perform:

CO1	Knowledge of importance,identification, classification and management of horticultural crops

CO2	Knowledge of different phases of horticultural crops and factors affecting the phases
CO3	Different techniques for plant propagation
CO4	Establishment of nursery for horticultural crops
CO5	Knowledge of plant propagating structures like greenhouse, poly-house, etc

Unit-I:
Horticulture - definition, importance, division and classification of horticultural crops. Importance of horticulture. Orchard planning, layout, planting systems, management practices. Tree forms and functions. Training and pruning in horticultural crops - principles and methods, techniques of training and pruning, fruit thinning.
Unit-II:
Phases of growth and development - vegetative/ reproductive balance; Flowering in plants - bearing habit and its classification- factors associated with flowering and fruit set. Fruit set and development - structure and process concerned with setting. Fruit drop - factors affecting and control measures - unfruitfulness - internal and external factors. Seedlessness in horticultural crops; significance and induction.
Unit-III:
Plant propagation - definition and basic concepts, sexual and asexual types - advantages and disadvantages. Media, containers, potting, re potting and pre planting treatments. Asexual propagation -propagation by cuttings, types of cuttings, factors affecting rooting of cuttings. Propagation by layering - types of layering. Propagation by grafting - methods of grafting - development of graft unions, separation and after care. Stock-scion relationship - Graft incompatibility - factors affecting incompatibility. Propagation by budding, methods of budding.
Unit-IV:
Nursery - site selection, layout - components of a nursery - production unit, sales unit, display area, management and maintenance, propagation unit - close planted progeny orchards. Plant propagating structures-. greenhouse, glasshouse, hot beds, cold frame, lath house, net house, mist chamber.

Reference books:
1. Denixon, RI. 1979. Principles of Horticulture. Mac Millan, New York.
2. Hartmann, HT. and Kester, DE.1986.Plant propagation - Principles andpractices.Prentice-Hall, New Delhi.
3. Chadha, K. L. 2003. Handbook of Horticulture, ICAR, New Dehi.
4. Choudhury, B.1983. Vegetables. National Book Trust, New Delhi.

Paper Title: Fundamentals of Horticulture-Practical
Paper Code: BVAG-105(P)
Credit: 2
Maximum Marks: 50

1. Familiarization to Different planting systems and layout.
2. Propagation methods - sexual propagation -seed viability tests, dormancy breaking methods.
3. Propagation structures - mist chamber, green house, hot beds, etc.
4. Propagation by cuttings.
5. Propagation by layering - types of layering.
6. Propagation by grafting - methods of grafting.
7. Propagation by budding, methods of budding.
8. Field visit to commercial horticulture farms and field training.

Paper Code: BVGA-106
Paper Title: Soil Science
Credit: 4
Maximum Marks: 100

Course Outcomes (COs)/Learning Outcomes
The knowledge and skill that the student acquire at the end of each course/paper:
At the end of the course the students will be able to acquire knowledge and/or perform:

CO1	Knowledge of various concepts of soil, types of soil in India
CO2	Knowledge of types, functions and deficiency symptoms of plant nutrients
CO3	Knowledge of soil fertility and its scientific management with fertilizers and manures
CO4	Management of problematic soils
CO5	Importance and functions of soil microorganisms

Unit-I:
Concepts of soil, formation, components and classification; different types of soil found in India. Soil organic matter- importance, organic matter depletion, causes of organic matter depletion, organicmatter replenishment- green manure, farm yard manure and animal manures, compost, cropresidues and organic wastes.
Unit-II:
Soil reaction pH, buffering, effect of pH on nutrient availability, soil acidity and alkalinity.Plant nutrients- classification, function and deficiency symptoms, nutrient cycles.Soil fertility evaluation:chemical analysis-soil analysis, plant analysis; biological tests; fertilizerrecommendation methods for crops and cropping patterns.
Unit-III:
Soil fertility and its management. Manures and fertilizers- classification and application, concept of integrated nutrient management. Fertilizer use efficiency**,** trends of fertilizer use in India. Imbalanced use of fertilizers. Problematic soils and their management.
Unit-IV:
Soil microflora and fauna- their role in agriculture.Role of soilmicroorganisms in nutrient transformation in relation to soil- plant system: **a)** Nitrogen: proteolysis, ammonification, nitrification and denitrification. b) Phosphorus: mineralization of organic phosphorus, oxidation-reductions reactions, solubilization of inorganic phosphates and c) Biochemical transformation of potassium.

Reference books:
1.Brady N.C. 1990. The Nature and Properties of Soils. Macmillan Pub. Co. Inc., New York.
2. Das, D.K. 2011. Introductory Soil Science. Kalayani Publishers, India.
3. Tisdale. S.L., Nelson. W.L., Beaton, J.D. and Havlin, J.I. 1997. Soil Fertility and Fertilizers. Macmillan Pub. Co., New York.
4. Kanwar. N.C. 1976. Soil Fertility-Theory and Practice. ICAR. New Delhi.
5..Mengel. K. and Kirkby, L.A. 1987. Principles of Plant Nutrition. Int. Potash lust. Pub. Switzerland.
6..Miller. R. W. and Donahuc. R.L. 1990. Soil-An Introduction to Soils and Plant Growth. Prentice Hall Inc., USA. .
7. Stevension, F.J. 1985. Cycles of Soils-Carbon, Nitrogen, Phosphorus. Sulphur, Micronutrients. John Wiley & Sons Inc.. New York.
8..Tamhane. R.U..Montiramani. D.P., Bali, Y.P. and Donahue, R.L. 1986. Soils Their Chemistry and Fertility in Tropical Asia. Prentice Hall of India Pvt.Ltd.. New Delhi.
9. Thomson. L.M. and Troeh. F.R. 1978. Soils and Soil Fertility. McGraw Hill, New York.
10. Alexander, M. 1977. Introduction to Soil Microbiology. John Wiley & Sons Inc., New York.

Paper Title: Soil Science-Practical
Paper Code: BVAG-106(P)
Credit: 2
Maximum Marks: 50

1. Use of soil sampling tools, collection, preservation and storage of soil sample.
2. Study of soil texture by feel method and hydrometer method.
3. Soil reaction measurement by indicators and glass electrode pH meter.

4. Determination of electrical conductivity.
5. Determination of Organic Carbon content.
6. Estimation of soil N P K S
7. Available Fe, Mn, Zn and Cu in soils
8. Determination of total NPK in plant samples
9. Determination of lime requirement of acid soils
10. Preparation of slides and microscopic examination of soil microbes
11. Visit to soil testing laboratories and training.

Semester-II

A. General Education (Core Papers)

Paper Title: Communication Skills and Personality Development
Paper Code: BVAG-201
Credit: 4
Maximum Marks: 100

Course Outcomes (COs)/Learning Outcomes
The knowledge and skill that the student acquire at the end of each course/paper:
At the end of the course the students will be able to acquire knowledge and/or perform:

CO1	The basic concept of communication, its need in current scenario & how communication is important for a conducting business.
CO2	Develop all-round personalities with a mature outlook to function effectively in different circumstances.
CO3	Become self-confident individuals by mastering inter-personnel skills, team management skills, and leadership skills.
CO4	Develop effective presentation skills. Become self-confident individuals by mastering inter-personal skills, team management skills, and leadership skills.
CO5	Develop all-round personalities with mature outlook to function effectively in different circumstances.

Unit-I:
Communication- Concept & process, forms of communication – verbal, visual and nonverbal, body language- Kinesics, Proxemics, Para-language. Media/Channels of Business Communication, Barriers to Business Communication and overcoming methods. Business reports and proposals writing- Importance, Need, Types, Techniques, Languages, Structure, Planning and drafting
Unit-2:
Workplace communication: Business correspondence- faxes, memo, e-mail, reports memorandums, meeting, documentation, etc. Meeting skill: Meeting agenda, illustration of agenda, guidelines, formal closure of meeting, action notesetc.
Negotiating skill: Introduction, phases of negotiation, characteristics of negotiation, critical factors, types of approaches etc. Use of concessions, concessions trading, avoiding use of trends, removing deadlock.
Unit 3:
Understanding Personality: Benefits of self-knowledge, Knowing oneself – JOHARI Window, Personality type, patterns of diversity, energy sources – Extroversion or Introversion. Ways to people like you. Make people think in your way. Analyze worry. Interpersonal processes and Transactional Analysis, confidence building, thinking creatively and Personal values- time and stress management.

Unit 4:
Personality Development Training: Interview skill-Interview dress code, controlling your nerves, Positive visualization, creating a positive impression, opening conversation, assessing the degree of formality, getting comfortable, recovering from poor starts etc. Group Discussion- Questions, attributes, individual characteristics, do's and don'ts, must's and must not's. Management Skills-Time management, keeping and analyzingtimelog,Tasktyping,effectivedecisionmaking,breakdauntingtasksetc.

Reference books:
1. Onkar,R.M., "Personality Development and Career Management" New Delhi, S. Chand andCompany.
2. Fisher, Dalmar, "Communication in Organisations" Mumbai,JaicoBooks.
3. Horner, David &Strutt, Peter "Words at Work", Cambridge UniversityPress.
4. Raman, Meenakshi& Singh, Prakash "Business Communication"Oxford University Press.
5. Sweeney, Simon "Communicating in Business" Cambridge UniversityPress.

Paper Title: Introduction to Information Technology
Paper Code: BVAG-202
Credit: 4
Maximum Marks: 100

Course Outcomes (COs)/Learning Outcomes
The knowledge and skill that the student acquire at the end of each course/paper:
At the end of the course the students will be able to acquire knowledge and/or perform:

CO1	Explain the evolution of various stages of computer.
CO2	Work with the various applications software's of computer.
CO3	The various concepts and components computer networks.
CO4	Comply with Management Information System (MIS) at various levels of management.
CO5	Investigate the importance of information technology in business decision making.

Unit-I:
Introduction to Computers- Origin, evolution & types. Components of Computers- hardware: Hardware elements -input, storage, processing & output devices. - Software: Operating software - DOS & Windows.
Unit-II:
ApplicationSoftware:WindowsBasedMS-Word,Excel,Powerpoint(MSoffice).
Internet:Browser,searchengine,WorldWideWeb,websites,e-mailetc.
Unit-III:
MeaningofInternet.ConceptsofInternetIntranetandExtranet,IPAddress(IPv4,IPv6),URL, DomainnameSystem.InternetProtocols-TCP/IP,UDP,FTPandTELNET(briefideasonly). HTML, DHTML AND XML. (concepts only). Data Communication: Concept of Data communications, Transmission Modes (Simplex, Half-Duplex, Full Duplex, Serial, Parallel, Synchronous, Asynchronous), Communication Media. Wireless and satellite communication, WirelessBroadband,WAP,Networkcomponents–Bridge,Switch,Router,Gateway.
Unit-IV:
ComputerNetworks**:**NetworkConcept,Types: LAN,WAN,MANVariousTopologies:Bus, Star, Ring, Mesh, Tree. Security threats - Virus, Trozan, Hacking, Spam. Security Measures-Firewall,Antivirussoftware,DigitalSignature.ConceptofdataEncryption &Decryption,Symmetricandasymmetricencryption.Digitalenvelope**.**Management InformationSystem(MIS),DecisionSupportSystem(DSS),KnowledgeManagement System (KMS) - and their implementation at managerial levels.

Reference books:
1. Yadav, D.S.: Fundamentals of Information Technology. New age International Publisher, NewDelhi.
2. Goel, R. &Kakkar, D.N.: Computer Applications in Management. New Age Publisher, New Delhi.
3. Saxena. S & Chopra, P.: Computer Applications in Management. Vikas Publishing House Pvt. Ltd. NewDelhi.
4. Lucey, T: Management Information System. BPB Publication, New Delhi,1997.
5. Obrien, James A.: Management Information System. Tata McGraw Hill Publication, New Delhi.
6. Fundamental of Computers, Prentice HallIndia Mastering Microsoft Office, Lonnie.E.Moseley, BPB Publication.

B. Ability Enhancement Paper: {BVAG-203A & BVAG-203A(P) / BVAG-203B & BVAG-203B(P)}

Paper: BVAG-203A
Title: Landscape Designing and Indoor Gardening
Credit: 2; Max. Marks: 50

Course Outcomes (COs)/Learning Outcomes
The knowledge and skill that the student acquire at the end of each course/paper:
At the end of the course the students will be able to acquire knowledge and/or perform:

CO1	Designing of landscape with traditional and computer aided techniques
CO2	Selection, planting and maintenance of appropriate crop plants for landscape agriculture
CO3	Knowledge of various garden tools, garden and lawn structures and maintenance
CO4	Establishment and maintenance of indoor gardens
CO5	Designing and maintenance of interior gardens

Unit-I:
Designing of landscape: Principle of landscape design. Selection and use of plants in the Landscape Preparation of landscape plan. Various soft wares used in garden designing. Digitalization in designing. Computer aided landscape designing - GIS.
Unit-II:
Maintenance of plants in landscape: Planting and maintenance of plants in the landscape. Methods of irrigation - sprinkler and drip irrigation-pot irrigation, wick irrigation etc. Methods of application of fertilizers to garden plants.
Unit-III:
Garden tools: Use of tools and implements. Use of different types of sprayers, lawn mowers, hedge cutters, tree cutters, levelling methods. Garden structures and garden types: Garden structures, roads and paths, enclosures, paving, garden lights, furniture. Different types of garden and features. Establishment and maintenance of lawn.
Unit-IV:
Indoor gardening: Selection of indoor plants. Layout and designs of indoor gardens - types of containers used, media composition, preparation of media, planting and placement of plants.
Models for interior plant scraping - vertical garden, miniature garden and terrariums. Manuring, irrigation, illumination, grooming and holiday care of indoor plants.

Reference books:

1. Edmond, JB., Sen, TD, Andrews, TS and Halfacre, RG. 1977. Fundamentals of Horticulture. Tata McGraw Hill, New Delhi.
2. Janick, J. 1963. Horticultural Science. W.H. Freeman, Sanfrancisco.
3. Kumar, N. 1990. Introduction to Horticulture, Rajalekshmi Publication, Nagercoil.
4. Carpenter, P.L., Walker, T.D and Lanphear, F.O. 1975. Plants in the Landscape.W.H. Feeman and Co., San Francisco.
5. Desai, B.L. 1979. Planning and Planting of Home Gardens. Indian Council of Agricultural Research, New Delhi.
6. Joiner, J.N. 1981. Foliage Plant Production. Prentice Hall Inc. London.
7. Nambisan, K.M.P. 1991. Design elements of landscape gardening. Oxford & IBH Publishers Pvt. Ltd, Calcutta.
8. Swarup, V. 1993. Indoor Gardening. ICAR, New Delhi.
9. Trivedi, P.P. 1983. Home Gardening. Indian Council of Agricultural research, New Delhi.
10. A.K. Tiwari and R. Kumar. 2012. Fundamentals of ornamental horticulture and landscape gardening. New India.
11. H.S.Grewal and Parminder Singh. 2014. Landscape designing and ornamental plants R.K. Roy. Fundamentals of Garden designing.2013.New India publishing agency, Pitampura, New Delhi.

Paper Title: Landscape Designing and Indoor Gardening-Practical
Paper Code: BVAG-203A(P)
Credit: 2
Maximum Marks: 50

1. Preparation of landscape plan, identification of plants.
2. Use of software in landscape designing, computer aided landscape designs.
3. Rolling and mowing of lawn - use of different types of lawn mowers.
4. Planting of trees and shrubs, preparation of flower beds. Pruning of shrubs, hedges and trees.
5. Application of manures and fertilizers to garden plants. Practice in different methods of irrigation in landscapes.
6. Selection and establishment of enclosures and paving.Layout of roads, paths and walks.
7. Preparation of rock garden.
8. Designing indoor garden.
9. Preparation of miniature garden and vertical garden.
10. Preparation of terrarium.
11. Field training.

Paper Title: Protected Cultivation
Paper Code: BVAG-203B
Credit: 2
Maximum Marks: 50

Course Outcomes (COs)/Learning Outcomes
The knowledge and skill that the student acquire at the end of each course/paper:
At the end of the course the students will be able to acquire knowledge and/or perform:

CO1	Knowledge of greenhouse technology
CO2	Identification of constrains of greenhouse cultivation
CO3	Selection of suitable greenhouse crops
CO4	Knowledge about various growing media for protected cultivation
CO5	Economic analysis of greenhouse cultivation

Unit-I:
Green house technology, Introduction, Types of Green Houses; Plant response to Greenhouse environment, Planning and design of greenhouses, Design criteria of greenhouse for cooling and

heating purposes. Green house equipment, materials of construction for traditional and low cost green houses.

Unit-II:
Irrigation systems used in greenhouses, Typical applications, passive solar green house, hot air greenhouse heating systems, green house drying. Cost estimation and economic analysis.
Unit-III:
Choice of crops for cultivation under greenhouses, problems / constraints of greenhouse cultivation and future strategies.
Unit-IV:
Growing media, soil culture, type of soil required, drainage, flooding and leaching, soil pasteurization in peat moss and mixtures, rock wool and other inert media, nutrient film technique (NFT) / hydroponics.

Reference books:
1. Balraj Singh. 2006. Protected cultivation of vegetable crops. Kalyani Publishers, Ludhiana.
2. Brahma Singh, 2014. Advances in Protected Cultivation. New India Publishing Agency. New Delhi.
3. Reddy P. Parvatha, 2003. Protected Cultivation. Springer Publications. USA.
4. Reddy, P. Parvatha. 2011. Sustainable crop protection under Protected Cultivation. Springer Publications. USA.
5. Jitendra Singh, 2015.Precision Farming in Horticulture. New India Publishing Agency. New Delhi.
6. Prasad S. 2005. Greenhouse Management for Horticultural Crops. Agrobios. Jodhpur.
8. Jitendra Singh, S.K. Jain, L.K. Dashora, B.S. Cundawat.2013. Precision forming in Horticulture. New India Publishing Agency, New Delhi.
9. T. Pradeep Kumar, B. Suma, JyothiBhaskar and K.N.Satheson. 2008. Management of Horticultural crops. New India Publishing Agency, New Delhi.
10. Aldrich RA & Bartok JW. 1994. NRAES,Riley, Robb Hall. Green House Engineering. Cornell University, Ithaca, New York.
11. Pant V Nelson. 1991. Green House Operation and Management. Bali Publ

Paper Title: Protected Cultivation-Practical
Paper Code: BVAG-203B(P)
Credit: 2
Maximum Marks: 50

1. Study of different types of greenhouses based on shape, construction and cladding materials.
2. Calculation of air rate exchange in an active summer winter cooling system.
3. Calculation of rate of air exchange in an active winter cooling system.
4. Estimation of drying rate of agricultural products inside green house.
5. The study of fertigation requirements for greenhouses crops and estimation of E.C. in the fertigation solution.
6. The study of various growing media used in raising of greenhouse crops and their preparation and pasteurization / sterilization.
7. Visit to commercial greenhouses and field training.

C. Skill Component Papers: Discipline Specific Papers

Paper Title: Fundamentals of Entomology
Paper Code: BVAG-204
Credit: 4
Maximum Marks: 100

Course Outcomes (COs)/Learning Outcomes

The knowledge and skill that the student acquire at the end of each course/paper:
At the end of the course the students will be able to acquire knowledge and/or perform:

CO1	Knowledge about the insect phylum Arthropoda
CO2	Identification and structure of insect morphology
CO3	Complete knowledge of agriculturally important insect species
CO4	Symptom identification and monitoring of insect pest
CO5	Insect pest management of important crops

Unit-I:
History of Entomology. Classification of phylum Arthropoda; Factors for insect abundance and success. Morphology –Grasshopper/Plant bug, structure and functions of insect cuticle. Moulting. Body segmentation. Structure of head, thorax and abdomen. Structure and modifications of insect mouth parts. Types of insect egg, larvae and pupae.
Unit-II:
Insect orders of agricultural importance- Lepidoptera, Coleoptera, Hemiptera, Diptera and Hymenoptera.
Unit-III:
Identification, symptoms of damage caused by pests of rice, banana, pepper, cardamom, brinjal, bittergourd and cowpea. Common pests of stored food products/grains. Pest monitoring - Pest surveillance and pest forecasting.
Unit-IV:
Pest management-common pesticides used in pest control. Management of important pests of cereal, vegetable and fruit crops. Concept of integrated pest management.

Reference books:
1.Awasthi, V.B. 1997. Introduction to General and Applied Entomology. Scientific Publishers, Jodhpur.
2. Borror, D.J., C.A. Triple Horn and N.F.Johnson. 1987. An Introduction to the Study of Insects (VI Edition). Harcourt Brace College Publishers, New York.
3. Chapman, R.F. 1981. The Insects: Structure and function. Edward Arnold (Publishers) Ltd, London.
4. Gullan, P.J. and Cranston, P.S. 2001. The Insects- An Outline of Entomology, II edition, Chapman & Hall, Madras.
5. Mani, M.S. 1968. General Entomology. Oxford and IBH Publishing Co. Pvt Ltd., New Delhi.
6. Nayar, K.K., T.N.Ananthakrishnan and B.V. David. 1976. General and Applied Entomology, Tata McGraw Hill Publishing Company Limited, New Delhi.
7. Saxena, S.C. 1992. Biology of Insects. Oxford and IBH Publishing Co. Pvt. Ltd., New Delhi.
8.Tembhare, D.B. 1997. Modern Entomology. Himalaya Publishing House, Mumbai.
9. Pedigo, L.P. 1999. Entomology and Pest Management. III Edition. Prentice Hall, New Jersey, USA.
10. H. Lewin and Devasahayam. Practical Manual of Entomology Insect and Non-insect pests.
11. Pant, N.C. and Ghai, S. 198. Insect Physiology and Anatomy. ICAR, New Delhi .
12. Snodgrass, R.E. 2001. Principles of Insect Morphology. CBS Publishers and Distributors, New Delhi.

Paper Title: Fundamentals of Entomology-Practical
Paper Code: BVAG-204(P)
Credit: 2
Maximum Marks: 50

1. Types of insect mouthparts.
2. Structure and modifications of insect antennae.
3. Structure and modifications of insect legs.
4. Types of insect larvae and pupae.
5. Identification of different types of insect damages on crop plants.

6. Identification, symptoms of damage, collection and preservation of pests of common cereal, vegetable and fruit crops.
7. Identification of pests of stored food grain/products.
8. Sampling techniques for the estimation of insect population in selected crops.
9. Estimation of insect damage in selected crops.
10. Field training.

Paper Title: Plant Pathology
Paper Code: BVAG-205
Credit: 4
Maximum Marks: 100

Course Outcomes (COs)/Learning Outcomes
The knowledge and skill that the student acquire at the end of each course/paper:
At the end of the course the students will be able to acquire knowledge and/or perform:

CO1	Knowledge of plant pathology and its related terminologies
CO2	Knowledge of disease causing organisms
CO3	Identification of important crop diseases
CO4	Crop disease management with cultural practices
CO5	Knowledge of chemical pesticides their use in crop disease management

Unit-I:
Introduction to the science of phytopathology, its objectives, scope and historical background. Classification of plant diseases, symptoms, signs, and related terminology. Definitions of terminology - bacteria, fungi, viruses, viroids, phytoplasmas, fastidious vascular bacteria, parasites, pathogens, biotrophs, hemibiotrophs, necrotrophs. Pathogenicity, pathogenesis, virulence, infection, inoculum, invasion, colonization, inoculum potential, symptoms, incubation period.
Unit-II:
Plant pathogens: fungi, bacteria, viruses, phytoplasma, protozoa, algae and flowering parasitic plants their characteristics. Important diseases of rice, maize, pulses, vegetables and fruit crops. Post-harvest and storage diseases.
Unit-III:
Principles and methods of plant disease management. Regulatory method, plant quarantine, inspection, rules and regulations. Cultural practices for plant disease management: sanitation, hot weather ploughing, soil amendments, crop rotation, time of sowing, seed rate and plant density, irrigation and drainage. Biological control and biopesticides.
Unit-IV:
Chemical methods of disease management: Fungicides, classification, chemical groups of fungicides, inorganic, organic, systemic, antibiotic. Methods of application of fungicides - seed, soil, foliar spray, post-harvest treatment and root feeding. Integrated plant disease management.

Reference books:
1. N.G. Ravichandra, 2013.Fundamentals of Plant Pathology. PHI Hall of India, NewDelhi
2. R.S. Mehrohtraans Ashok Agarwal. Fundamental of Plant Pathology.
3. Sambamurthy. A Textbook of Plant Pathology.
4. R.S.Singh. Introduction to Principles of Plant Pathology.
5. Alexopoulos, C.J. Mims, C.W. and Blackwell, M. 1996. Introduction to Mycology. Wiley Eastern Ltd., New York.
6. Mandahar,C.L. 1987. Introduction to Plant Viruses. Chand and Co. Pvt. Ltd., New Delhi.
7. Mehrotra, R.S. and Aneja, K.R. 1990. . An Introduction to Mycology. New Age International (P) Ltd., New Delhi.
8. Singh, R.S. 1982. Plant Pathogens - The Fungi. Oxford and IBH Publishing Co., New Delhi.
9. Singh, R.S. 1989. Plant Pathogens - The Prokaryotes .Oxford and IBH Publishing Co., NewDelhi.

10. Dhingra and Sinclair 1993. Basic Plant Pathology Methods. CBS, Publishers & Distributors, New Delhi.
11. Agrios, G.N. 2006. Plant Pathology. Elsevier Academic press, London.

Paper Title: Plant Pathology-Practical
Paper Code: BVAG-205(P)
Credit: 2
Maximum Marks: 50

1. Methods of sterilization.
2. Preparation of common culture media for fungi and bacteria.
3. Pure culture technique.
4. Common symptoms of plant diseases caused by fungi bacteria and viruses.
5. Field identification and laboratory examination of common crop diseases.
6. Familiarization with different groups of fungicides.
7. Preparation of fungicidal spray solutions- methods of application of fungicides - spraying and soil drenching.
8. Seed treatment with systemic and contact fungicides.
9. Preparation and application of botanicals.
10. Familiarization with plant protection equipment.
11. Field visits, survey and collection of disease samples.

Paper Title:Agricultural Economics
Paper Code: BVAG-206
Credit: 4
Maximum Marks: 100

Course Outcomes (COs)/Learning Outcomes
The knowledge and skill that the student acquire at the end of each course/paper:
At the end of the course the students will be able to acquire knowledge and/or perform:

CO1	Concepts of economics and agricultural economics
CO2	Various principles associated with demand
CO3	Various principles associated with return
CO4	Agricultural financing system
CO5	Agricultural planning of India

Unit-I:
Economics:Meaning, scope and subject matter, definitions, activities, approaches to economic analysis; micro- and macro- economics, positive and normative analysis. Agricultural economics: meaning, definition, characteristics of agriculture, importance and its role in economic development. Agricultural planning and development in the country.
Unit-II:
Demand: meaning, law of demand, schedule and demand curve, determinants, utility theory; law of diminishing marginal utility, equi-marginal utility principle. Consumer's equilibrium and derivation of demand curve, concept of consumer surplus. Elasticity of demand: concept and measurement of price elasticity, income elasticity and cross elasticity. Production: process, creation of utility, factors of production, input output relationship.
Unity-III:
Laws of returns: Law of variable proportions and law of returns to scale. Cost: concepts, short run andlong run cost curves. Supply: Stock v/s supply, law of supply, schedule, supply curve, determinantsof supply, elasticity of supply. Market structure: meaning and types of market, basic features ofperfectly competitive and imperfect markets. Distribution theory: meaning, factor market and pricing of factors of production. Concepts ofrent, wage, interest and profit.

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

Paper Title:Agricultural Economics -Practical
Paper Code: BVAG-206(P)
Credit: 2
Maximum Marks: 50

1. To work out the cost of cultivation of an important crop like rice, maize, potato, pea, etc.
2. Preparation of cropping scheme of a farm showing detailed layout, input requirement, expected income and profit (by visiting to relevant farms).
3. Report presentation and viva-voce.

Semester-III

A. General Education (Core Papers)

Paper Title:Government Policies and Programs in Relation to Agriculture
Paper Code: BVAG-301
Credit: 4
Maximum Marks: 100

Course Outcomes (COs)/Learning Outcomes
The knowledge and skill that the student acquire at the end of each course/paper:
At the end of the course the students will be able to acquire knowledge and/or perform:

CO1	Knowledge about national and state agricultural policies
CO2	Various regulations related to agricultural policies like land holding, agricultural labour, minimum wage and NREGP
CO3	Knowledge about policies for agricultural inputs like crop seeds, fertilizers, pesticides and agricultural tools
CO4	Knowledge about agricultural credit policies
CO5	Knowledge about policies for marketing and export of agricultural produces

Unit-I:Introduction to agricultural policies.Introduction to agricultural policies of Manipur and of India - need and importance – National Agricultural Policy in brief.
Unit-II:
Agricultural policies regarding land - need and scope for land reforms - Abolition of intermediaries - Tenancy reforms - Ceiling on land holdings - appraisal of land reforms.-Size pattern of operational holdings, problem of sub-division and fragmentation of holdings. Agricultural policies regarding labour - present position of agricultural labour – minimumwages - abolition of bonded labour - Recommendations of the National Commission on RuralLabour – NREGP.
Unit-III:
National Seeds Policy -varietal development and plant variety protection - seed production - quality assurance - seed distribution and marketing - infrastructure facilities - transgenic plant varieties - import of seeds and planting material - export of seeds -promotion of domestic seed industry. Fertilizer pricing policy - payment of subsidy. Pesticide production and consumption in India -

protection of consumers from adverse impacts of pesticides. Agricultural policies regarding irrigation, machinery, technology etc.

Unit-IV:
Agricultural policies regarding credit - Co-operatives and rural credit - Commercial banks and rural credit - Regional Rural Banks - Lead Bank Scheme - NABARD. Agricultural policies of Manipur and of India- regarding agricultural products and their marketing, export and prices -food security.

Reference books:
1. Government of India. Five year Plan Documents.
2. Government of India. Economic Survey. Published by Planning Commission (various issues).
3. Government of India. Economic Review. Published by State Planning Board (various issues).

Paper Title:Basics of Accounting and Finance
Paper Code: BVAG-302
Credit: 4
Maximum Marks: 100

Course Outcomes (COs)/Learning Outcomes
The knowledge and skill that the student acquire at the end of each course/paper:
At the end of the course the students will be able to acquire knowledge and/or perform:

CO1	The basics of accounting and objectives of accounting management.
CO2	Explain the accounting principles, conventions and accounting standards.
CO3	Investigate the process and procedures of Recording of financial transactions in business.
CO4	Prepare the Final accounts statements of an enterprise.
CO5	Work with accounting software.

Unit-I:
Introduction – financial accounting – definition and scope, objectives of financial accounting, accounting v/s book keeping, Terms used in accounting users of accounting information and limitations of financial accounting.
Unit-II:
Conceptual framework – accounting concepts, principles and conventions, accounting standards-concepts objectives, benefits Brief review of Accounting Standards in India, Accounting Policies, Valuation Principles.
Unit-III:
Recording of transactions – Voucher System, Accounting Process,Journals, subsidiary books, ledger, cash book, bank reconciliation statement, trial balance. Depreciation: Meaning, need & importance of depreciation, methods of charging depreciation.(WDV &SLM).
Unit-IV:
Preparation of Final accounts – preparation of trading and Profit & Loss Account and Balance sheet of sole proprietary business with adjustments. Basics of computerized accounting – journalizing and preparing final accounts of company, using Accounting software packages (TALLY).

Reference books:
1. Gupta R. L. and Radhaswamy M., ‘Advanced Accounting’. Sultan chand& Sons, New Delhi.
2. Shukla M. C., Grewal T. S. and S.C. Gupta, ‘Advanced Accounts’. S. Chand & Co. Ltd., NewDelhi
3. JainS.P.andNarangP.L.,‘FinancialAccounting’,KalyaniPublishers,NewDelhi.
4. Naseem Ahmed, Nawab Ali Khan Gupta M.L., ‘Fundamentals of financialAccounting: Theory and Practice’,Ane Books Pvt. Ltd.New Delhi.

B. Ability Enhancement Paper: {BVAG-303A & BVAG-303A(P) / BVAG-303B & BVAG-303B(P)}

Paper Title: Mushroom Cultivation
Paper Code: BVAG-303A
Credit: 2
Maximum Marks: 50

Course Outcomes (COs)/Learning Outcomes
The knowledge and skill that the student acquire at the end of each course/paper:
At the end of the course the students will be able to acquire knowledge and/or perform:

CO1	Knowledge about importance of mushroom cultivation and selection of suitable mushroom species for commercial production
CO2	Designing and construction of mushroom farm
CO3	Technology for spawn production, compost preparation, cultivation and maintenance of mushroom crops
CO4	Commercial production of *Pleurotus, Volvareilla,Lentinula* and *Agaricus*
CO5	Management of insect pests and diseases of mushroom crops

Unit-I:
Definition of mushrooms, present scenario of mushroom cultivation, uses, nutritional and medicinal values of mushrooms. Selection of commercially important types of mushroom, selection of appropriate mushroom cultivation sites, design and construction of mushroom farm and disinfection.
Unit-II:
Procurement of mother culture and spawn production. Composting in mushroom cultivation, materials for preparation of different types of compost, pasteurization of compost. Procurement of casing soil and preparation for production. Mushroom seeding, casing with soil and maintenance.
Unit-III:
Cultivation methods for *Pleurotus, Volvareilla,Lentinula* and *Agaricus*. Methods of harvesting, processing, grading and packing. Marketing and cost economics of mushroom culture. Use of spent Mushroom in vermin-composting and in organic farming.
Unit-IV:
Disease control and pest management: types of diseases and pest of mushrooms, use of sterilized casing to control nematodes, use of fungicides after casing to check dry bubble, spraying insecticides for control of mites.

Reference books:
1. Mushroom cultivation by S. Rajan and N. Sivakumar.
2. Mushrooms cultivation by D.R. Tripathi.
3. Mushroom Production and Processing Technology, PathakYadavGour (2010). Published by Agrobios (India).
4. A hand book of edible mushroom, S.Kannaiyan&K.Ramasamy (1980). Today & Tomorrows printers & publishers, New Delhi.
5. Handbook on Mushrooms, Nita Bahl, oxford & IBH Publishing Co.

Paper Title: Mushroom Cultivation-Practical
Paper Code: BVAG-303A(P)
Credit: 2
Maximum Marks: 50

1. Identification of edible mushrooms.
2. Collection of raw materials, compost and composting.

3. Cultivation of oyster mushroom.
4. Spawn and spawning, casing and case run.
4. Cropping and crop management, picking and packing.
5. Visit to relevant labs and mushroom production centers.

Paper Title: Commercial Silkworm Seed Production
Paper Code: BVAG-303B
Credit: 2
Maximum Marks: 50

Course Outcomes (COs)/Learning Outcomes

The knowledge and skill that the student acquire at the end of each course/paper:
At the end of the course the students will be able to acquire knowledge and/or perform:

CO1	Knowledge about importance of silkworm quality seeds in sericulture and embryology of important silkworm species
CO2	Identification of local, national and international silkworm seed areas/organizations
CO3	Knowledge of three tier system of silkworm egg production and associated technologies
CO4	Standard techniques for rearing of parental silkworm, egg production and preservation of eggs
CO5	Establishment of silkworm seed production unit

Unit-I:
Importance of quality silkworm seed in sericultural industry. Embryology of *Bombyxmori*,*Samiacynthiaricini*and *Antheraeamylitta*. Morphological and Biochemical changes in eggs of different silkworms during embryogenesis. Seed areas, special features of seed areas and seed cocoon transaction. Seed organization in India and abroad.
Unit-II:
Three tier system of egg production (P3, P2 and P1). Special features of parental silkworm rearing, basic seed and industrial seed and standards for the same. Hill amelioration, marketing of seed cocoons, grainage techniques and steps in hybrid dfl preparation.
Unit-III:
Methods of termination of hibernation, acid treatment for hibernating eggs. Egg borne diseases and methods of elimination. Pebrine disease management at various levels. Incubation and preservation of DFLs till disposal. Standards for quality eggs. Preservation and handling of eggs, different hibernation schedules.
Unit-IV:
Planning for egg production. Rearing of parental silkworm breeds. Preparation of grainage, working out the disinfectant solution required to disinfect the grainage building. Production of commercial silkworm eggs in egg sheets and as loose forms. Practicing of different methods of artificial hatching. Preservation of multivoltine pupa/moths/eggs.

Reference books:
1. Narasimhanna, M.N., 1988, Manual on Silkworm Egg Production. Central Silk Board,Bangalore.
2. Dandin, S.B. and Giridhar, K., 2010, Hand Book of Sericulture Technologies, Central SilkBoard, Bangalore.
3. Ganga, G., 2003. Comprehensive Sericulture- Vol. 2. Oxford and IBH Publishing Co. Pvt. Ltd.,New Delhi.
4. Ganga, G. and SulochanaChetty, J., 2001. An Introduction to Sericulture. Ashish PublishingHouse, New Delhi.
5. Narasimhanna, M.N., 1988. Manual on Silkworm Egg Production. Central Silk Board,Bangalore.
6. Dandin, S.B. and Giridhar, K., 2010. Hand Book of Sericulture Technologies, Central Silk Board,
7. Tribhuwan Singh and BeeraSaratchandra, 2004. Principles and Techniques of Silkworm Seed Production. Discovery Publishing House, New Delhi.

8. Jayaswal, J., Giridhar, K., Somi Reddy, J. And JagadishPrabhu, H., 2008, Mulberry SilkwormSeed Production. Central Silk Board, Bangalore.
9. A Treatise on the Acid Treatment of Silkworm Eggs. Central Sericultural Research & TrainingInstitute, Mysore.
10. FAO Manuals on Silkworm Egg Production.

Paper Title:Commercial Silkworm Seed Production-Practical
Paper Code: BVAG-303B(P)
Credit: 2
Maximum Marks: 50

1. Methods of embryo testing and preparation of permanent slides**.**
2. Grainage plan and equipments, different grainage operations, procurement, transportation and preservation of seed cocoons, sexing, moth emergence, pairing, depairing, preparation of eggs on cards and as loose forms.
3. Identification of good, dead, unfertile and hibernated eggs.
4. Mother moth examination, disinfection of eggs.
5. Acid treatment for hibernating eggs.
6. Visit to local grainages.

C. Skill Component Papers: Discipline Specific Papers

Paper Title:Fundamentals of Genetics
Paper Code: BVAG-304
Credit: 4
Maximum Marks: 100

Course Outcomes (COs)/Learning Outcomes
The knowledge and skill that the student acquire at the end of each course/paper:
At the end of the course the students will be able to acquire knowledge and/or perform:

CO1	Concepts of chromosome structure
CO2	Concepts of pre- and post Mendelian genetic principles and the underlying significance in heredity
CO3	Various processes of cell cycle and cell division and their significances in genetics
CO4	Underlying principles of genetic disorders
CO5	Gene structure, function and regulation

Unit-I:
Architecture of chromosome; chromonemata, chromosome matrix, chromomeres, centromere, secondary constriction and telomere; special types of chromosomes.
Unit-II:
Pre and post Mendelian concepts of heredity, Mendelian principles of heredity. Probability and Chi-square. Dominance relationships, epistatic interactions with example. Multiple alleles, pleiotropism and pseudoalleles, sex determination and sex linkage, sex limited and sex influenced traits, blood group genetics, linkage and its estimation.
Unit-III:
Chromosomal theory of inheritance - Cell cycle and cell division- mitosis and meiosis. Crossing over mechanisms, chromosome mapping. Mutation, classification, Methods of inducing mutations & CIB technique, mutagenic agents and induction of mutation. Structural and numerical variations in chromosome and their implications, Use of haploids, dihaploids and doubled haploids in Genetics.
Unit-IV:

Qualitative and quantitative traits, polygenes and continuous variations, multiple factor hypothesis, cytoplasmic inheritance. Genetic disorders. Nature, structure and replication of genetic material. Protein synthesis: transcription and translational mechanism of genetic material. Gene concept: gene structure, function and regulation, Lac and Trp operons.

References books:
1. Peter K.V. 1998. Genetics and Breeding of Vegetables, ICAR New Delhi.
2. Singh, B. D. 2001. Fundamentals of genetics, Kalyani Publishers, New Delhi
3.Singh, B.D. Fundamentals of Geetics.
4. Singh, B.D. Objective Genetics. Kalyani Publishers, New Delhi.

Paper Title:Fundamentals of Genetics-Practicals
Paper Code: BVAG-304(P)
Credit: 2
Maximum Marks: 50

1. Microscopic study of cell structure.
2. Mitosis and Meiosis cell division.
3. Experiments on monohybrid, dihybrid, trihybrid, test cross and back cross.
4. Experiments on epistatic interactions including test cross and back cross.
5. Practice on mitotic and meiotic cell division.
6. Experiments on probability and Chi-square test.
7. Determination of linkage and cross-over analysis (through two point test cross and three point test cross data).
8. Study on sex linked inheritance in *Drosophila*.
9. Study of models on DNA and RNA structures.

Paper Title:Plant Breeding
Paper Code: BVAG-305
Credit: 4
Maximum Marks: 100

Course Outcomes (COs)/Learning Outcomes
The knowledge and skill that the student acquire at the end of each course/paper:
At the end of the course the students will be able to acquire knowledge and/or perform:

CO1	Concept and role of plant breeding in crop improvement
CO2	Various techniques of plant breeding for self- pollinated crop plants
CO3	Various techniques of plant breeding for asexually propagated crop plants
CO4	Uses of biological markers for plant breeding
CO5	Concepts of IPR, Patenting and Plant Breeder's and Farmer's Rights

Unit-I:
Historical development, concept, nature and role of plant breeding, major achievements and future prospects. Genetics in relation to plant breeding, modes of reproduction and apomixes, self-incompatibility and male sterility- genetic consequences, cultivar options.
Unit-II:
Domestication, acclimatization and introduction; Centres of origin/diversity, components of genetic variation; Heritability and genetic advance. Genetic basis and breeding methods in self- pollinated crops - mass and pure line selection, hybridization techniques and handling of segregating population; Multiline concept.
Unit-III:

Breeding methods in asexually propagated crops, clonal selection and hybridization; Maintenance of breeding records and data collection; Wide hybridization and pre-breeding. Polyploidy in relation to plant breeding, mutation breeding-methods and uses.
Unit-IV:
Biotechnological tools-DNA markers and marker assisted selection. Participatory plant breeding; Intellectual Property Rights, Patenting, Plant Breeders and & Farmer's Rights.

Reference books:

1. Singh, B. D. Plant Breeding : Principles. Klyani Publishers, New Delhi.
2. Singh, B.D. and Prasad, B.K. Objective Plant Breeding. Kalyani Publishers, New Delhi.
3. Rana, M.K. 2011. Breeding and Protection of Vegetables.
4. Allard, R.W. 1960. Principles of Plant Breeding.John Wiley & Sons INC. USA. Toppan Co. Ltd. Japan
5. Choudhari, T.C. 1982. Introduction to Plant Breeding. Oxford A& IBH Publishing Co., New Delhi
6. Elliot. 1958. Plant Breeding &Cytogenetics. Mc Grow Hill. New York

Paper Title:Plant Breeding-Practical
Paper Code: BVAG-305(P)
Credit: 2
Maximum Marks: 50

1. Plant Breeder's kit.
2. Study of germplasm of various crops.
3. Study of floral structure of self-pollinated and cross pollinated crops.
4. Emasculation and hybridization techniques in self and cross pollinated crops.
5.Study of male sterility system.
6.Methods of calculating mean, range, variance, standard deviation, heritability.
7.Designs used in plant breeding experiments, analysis of Randomized Block Design.
8. To work out the mode of pollination in a given crop and extent of natural out-crossing.
9. Visits to plant breeding centres.

Paper Title:Crop Physiology
Paper Code: BVAG-306
Credit: 4
Maximum Marks: 100

Course Outcomes (COs)/Learning Outcomes
The knowledge and skill that the student acquire at the end of each course/paper:
At the end of the course the students will be able to acquire knowledge and/or perform:

CO1	Importance of plant physiology in agriculture
CO2	Transpiration and stomatal physiology
CO3	Classification and functions of macro- and micro-plant nutrients
CO4	Biochemical process of photosynthesis
CO5	Physiological role and agricultural uses of growth regulators

Unit-I:
Introduction to crop physiology and its importance in agriculture; plant cell: an overview; diffusion and osmosis; absorption of water, transpiration and stomatal physiology.
Unit_II:
Mineral nutrition of plants: classification and functions plant nutrients; deficiency symptoms of macro- and micro-nutrients; nutrient uptake mechanisms.
Unit-III.

Photosynthesis: light and dark reactions, C3, C4 and CAM plants; Respiration: glycolysis, TCA cycle and electron transport chain. Fat Metabolism: fatty acid synthesis and breakdown.

Unit-IV:

Plant growth regulators: types, physiological roles and agricultural uses; physiological aspects of growth and development of major crops: Growth analysis, role of physiological growth parameters in crop productivity.

Reference books:
1. Salisbury. 2007. Plant Physiology.CBS. New Delhi.
2. Taiz, L. 2010. Plant Physiology.SINAUR. USA.
3. Noggle G.R and Fritz T.G. Introductory Plant Physiology

Paper Title:Crop Physiology-Practical
Paper Code: BVAG-306(P)
Credit: 2
Maximum Marks: 50

1. Study of plant cells, structure and distribution of stomata.
2. Imbibitions, osmosis, plasmolysis, measurement of root pressure, rate of transpiration.
3.Separation of photosynthetic pigments through paper chromatography.
4.Rate of transpiration, photosynthesis and respiration.
5.Tissue test for mineral nutrients, estimation of relative water content.
6. Measurement of photosynthetic CO2 assimilation by Infra Red Gas Analyser (IRGA).
7. Visit to relevant labs.

Semester-IV

A. General Education (Core Papers)

Paper Title:Entrepreneurship Development: Theory and Practice
Paper Code: BVAG-401
Credit: 4
Maximum Marks: 100

Course Outcomes (COs)/Learning Outcomes
The knowledge and skill that the student acquire at the end of each course/paper:
At the end of the course the students will be able to acquire knowledge and/or perform:

CO1	The concept of Entrepreneurship, its types and traits.
CO2	Explain the various theories of motivating individuals.
CO3	Conduct situation analysis and understand the prospect of potential business.
CO4	Develop and design creative and innovative business ideas.
CO5	Investigate the various modalities for enterprise creation and its operations.

Unit-I:
The concept of Entrepreneurship: Definition, Significance; Types of entrepreneurs, characteristics-

functions, Charms of being an Entrepreneur, Entrepreneurial traits, Distinction between entrepreneur and manager, Entrepreneur and intraprenuer, Entrepreneur and Entrepreneurship- traits and motivation- Theories of motivation- Maslow's Need Hierarchy theory ,McClelland's Three Needed model and Aldefer's ERG theory. Problems faced by a newentrepreneur.

Unit-II:

Entrepreneurship and Intrapreneurship. Entrepreneurial process; identification of an opportunity, market assessment, analyzing competitive situation, understanding trade practices, resource mobilization. Entrepreneurship as a preferred "Career Option". Role and Importance of Entrepreneur in economic growth and socially responsible business. Factors affecting entrepreneurial growth in general.

Unit-III:

EDP- Meaning and Objectives, Understanding and developing creativity and innovation;Creativity-Generating and implementing ideas, creative thinking skills (imaginative problem solving) and motivation (passion for specific challenges), Strategies to boost employee's expertise (technical, intellectual and procedural). Innovation: Sources of innovation, innovation management. Women empowerment and entrepreneurship.

Unit-IV:

Environment scanning, sources of information (primary, secondary), Product Selection, Technology determination, Site selection, Legal requirements of establishment of a new unit and rising funds, Venture capital sources and documentation required, Financial planning, Financial Assistance for small enterprises- bank loans, Angel funding, KVIC, PMEGP etc.

Reference books:

1. Peter Drucker, 'Innovation andEntrepreneurship'
2. Desai, V. Dynamics of Entrepreneurial Development and management. Himalaya Publishinghouse.
3. Gupta, C.B. &Srinivasan, N.P – Entrepreneurialdevelopment.
4. D N Mishra, 'Entrepreneur and Entrepreneur Development &Planning'.
5. Baporikar Neeta. (2011), Entrepreneurship Development and Project Management, Himalaya: NewDelhi.
6. AroraRenu&Sood. S. K (2007), Entrepreneurship Development and Management, Kalyani, NewDelhi.
7. Abraham M.M., Entrepreneurship Development and Project Management, Prakash: Changanacherry..
8. Vasant Desai, Entrepreneurship & Small Scale Industries, HimalayaPublishers.
9. Vasant Desai, Entrepreneurship Development, HimalayaPublishers.

Paper Title:Business Mathematics and Statistics
Paper Code: BVAG-402
Credit: 4
Maximum Marks: 100

Course Outcomes (COs)/Learning Outcomes

The knowledge and skill that the student acquire at the end of each course/paper:
At the end of the course the students will be able to acquire knowledge and/or perform:

CO1	Knowledge of mathematical and statisticsconcepts.
CO2	Demonstrate and apply the mathematical function and calculations in the day-to-day operations of business.
CO3	Explain the concept of statistics in the decision making of management.
CO4	Use different mathematical and statistical techniques and apply in different functions and operations of business.
CO5	Understand the importance of statistics in marketing research, quality management, financial management etc.

Unit-I:
Statistics -Definition- Scope andLimitation- Presentation of Data -Diagrammatic and Graphical Representation ofData. Measures of Central Tendency-Mean-Median and Mode-GM and HM-theirLimitations.
Unit-II:
Measures of Dispersion-Range-Mean Deviation-Quartile Deviation–Standard Deviation - CoefficientVariation-LorenzCurve-Measures of Skewness-Karl Pearson and Bowley's methods.

Unit-III:
Mathematics forFinance-Simple and CompoundInterest Annuities-SinkingFunds- Discounts and Present values.
Unit-IV:
Basic Calculus-Rulesfor Differentiation-Maxima and Minima and theirApplications to Business.

Referencebooks:
1. J.K. Sharma - Business Statistics -Pearson Publications
2. P. Navaneetham-Business Statistics and Mathematics
3. P.R. Vittal-Business Statistics and Mathematics
4. David M.Levine: Business statistics
5. S.P. Gupta; Statistical methods

B. Ability Enhancement Paper: {BVAG-403A & BVAG-403A(P) / BVAG-403B & BVAG-403B(P)}

Paper Title:Bee Keeping
Paper Code: BVAG-403A
Credit: 2
Maximum Marks: 50

Course Outcomes (COs)/Learning Outcomes
The knowledge and skill that the student acquire at the end of each course/paper:
At the end of the course the students will be able to acquire knowledge and/or perform:

CO1	Site selection for bee rearing
CO2	Knowledge of bee species, morphology and anatomy and colony structure
CO3	Knowledge of biology and behaviour of bees
CO4	Queen rearing and colony multiplication
CO5	Planning and management of bee keeping

Unit-I:
History and development of Bee-keeping. How, when and where to start bee-keeping. Species of honeybees, morphology and anatomy, glandular system in relation to behaviour and their colony structure.
Unit-II:
Bee biology, caste determination, swarming and its prevention; robbing and its prevention. Age related activities of workers. Communication in honeybees.
Unit-III:
Queen rearing and multiplication of colony. Queenless colonies and their rectification. Seasonal management practices. Study of bees as pollinators, bee flora and pollination management.
Unit-IV:
Pests and diseases of bees. Hive products and their uses. Poisoning of bees and its prevention. Economics of bee keeping.

Reference books:
1. Singh, S., 1975. Bee keeping in India – ICAR, New Delhi., 214p.
2. Sunita, N.D, Guled ,M.B, Mulla S.R and Jagginavar,2003, Beekeeping
3. Mishra, R.C. and Rajesh Gar. 2002. Prospective in Indian Apiculture. Agrobios, Jodhpur.
4. Singh, D and Singh, D.P. 2006. A hand book of Beekeeping, Agrobios (India).
5. Paul DeBach and Devid Rosen 1991. Biological control by natural enemies. Cambridge University Press; 2 edition (27 June 1991).

Paper Title:Bee Keeping-Practical
Paper Code: BVAG-403A(P)
Credit: 2
Maximum Marks: 50

1. Identification of honeybee species, their castes, comb structure and stages.
2. Handling of bee colony and colony inspection.
3. Study of beehives and bee keeping equipment.
4. Dissection of worker bees to study different morphological and anatomical characteristics.
5. Hiving of colony, management practices like feeding, dividing, uniting, prevention of swarming, robbing and absconding.
6. Fixing comb foundation sheet, providing of super chamber; extraction, processing and testing of honey and other products.
7. Study of bees as pollinators.
8. Identification of bee flora.
9. Identification of bee pests and diseases.
10. Visit to important apiaries and bee keeping societies around the region.

Paper Title:Piggery
Paper Code: BVAG-403B
Credit: 2
Maximum Marks: 50

Course Outcomes (COs)/Learning Outcomes
The knowledge and skill that the student acquire at the end of each course/paper:
At the end of the course the students will be able to acquire knowledge and/or perform:

CO1	Identification of indigenous and exotic breeds of pig in Manipur and India
CO2	Designing and maintenance of pig shed
CO3	Knowledge about reproductive characters and breeding of pigs
CO4	Feeding and caring of pigs at different growth stages
CO5	Knowledge about normal physiology and health care of pigs

Unit-I:
Definitionofpiggery.Roleofpiggeryinhumannutrition,selfemploymentandeconomicprogress. Breedsofpig:Nameofrecognizedindigenousbreedsofpig.Nameofexoticbreedsofpigexperiencedin Indiaandtheirclassificationaccordingtoorigin.Characteristicsandproductioncapabilitiesofimportantpigbreeds suitable in Manipur.
Unit-II:
Pighousing:Spacerequirementsfordifferentcategoriesofpigs.Designofpigshed.Specialprovisioninfarrowingpentopreventtramplingbymother.Cleaningandsanitationofpigshed. Reproductioncharacteristicsofpig– estrouscycle,signsofestrus,gestationperiod,ageatfirstmating,farrowing,littersize.Selectionofsow.Selectionof breedingboar.Geneticimprovementofnon-descriptpigs–gradingup,crossbreeding.
Unit-III:

Feedsandfeeding:Commonfeedingredientsforpigfeed.Preparationoffeedfordifferentcategoriesofpigs.Waterrequirementsofpigs.Examplesofcheapfeedforhomesteadpiggery.Pasturegrazingofpig.Practicalfeedingofpigs.Generalmanagementpractices:Salientfeaturesofcareandmanagementofvariousstagesofpigs– careofpiglets,careofsowduringpregnancyandparturition,careofbreedingbuck,andcareoffatteningpigs.

Unit-IV:
Maintenanceofhealth: Normalphysiologicalconditionsofpigs– bodytemperature,respirationrate,pulserate.Importantpigdiseases.Generalhealthcontrolmeasures– sanitationandhygiene,regulardeworming andregularvaccinationagainstdreadfuldiseases.

Referencebooks:
1.
SahajKathaiVigyanShukorPalanOSwasthyaRaksha(ScientificPigRearingandHealthCareinSimpleLanguage,inBengali)byDr.NilotpalGhosh(MehanatiProkashani,Hooghly).
2. SwineProduction(inEnglish)byD.P.Sharda(IndianCouncilofAgriculturalresearch,NewDelhi).
3. SwineProductionandHealthManagement(inEnglish)byU.Dimri(NewIndiaPublishingAgency,New Delhi).
4. Goat,SheepandPigProductionandManagement(inEnglish)byJ.Prasad(KalyaniPublishers,NewDelhi).

Paper Title:Piggery-Practical
Paper Code: BVAG-403B(P)
Credit: 2

Maximum Marks: 50
1. Studyofexternalbodypartsofpig and identificationofdifferentbreedsofpigs.
2. Recordingofrectaltemperature,respirationrateandpulserateofpig
3. Selectionofbreedingboarandsow.
4. Studyofcommonfeedingredientsforpigs.
5. Preparation of concentratemixturesforpiglets,growersandadultpigs.
6. Studyofreadymadepigfeedsavailableinthemarket and feedingscheduleforpigs.
7. Careofgilt/sowduringpregnancy and careofnewbornpiglets.
8. Routinedewormingand vaccination procedures.
9. Useofvitaminandmineralsupplements.
10. Cleaninganddisinfectionofpiggery.
11. Visittopigfarmandpreparationofreport.

C. Skill Component Papers: Discipline Specific Papers

Paper Title:Agricultural Meteorology
Paper Code: BVAG-404
Credit: 4

Course Outcomes (COs)/Learning Outcomes
The knowledge and skill that the student acquire at the end of each course/paper:
At the end of the course the students will be able to acquire knowledge and/or perform:

CO1	Concept of weather and climate and importance of meteorology in agriculture
CO2	Knowledge about composition and physical characteristics of atmosphere and global distribution of wind and atmospheric pressure
CO3	Knowledge about cloud classification and rainfall and cloud seeding
CO4	Monsoon pattern and variations across India including Manipur

CO5	Techniques and importance of weather forecasting in agriculture

Unit-I:

Introduction to meteorology and agricultural meteorology- Scope and importance of Agricultural Meteorology- Composition of Atmosphere- Role of greenhouse gases in global cooling and warming- Concept of weather and climate- Micro-meso-macro and phyto-climates , soil temperature and its variations.

Unit-II: Electromagnetic spectrum- Nature and properties of solar radiation- short wave radiation and long wave radiation- thermal structure of atmosphere- vertical profiles factors affecting surface air temperature-spatial and temporal variations in surface air temperature- soil temperature and its variation- Atmospheric pressure and its variation with height- Global distribution of pressure and wind- Atmospheric Humidity- saturation and actual vapour pressure-relative humidity and dew point temperature.

Unit-III:

Cloud classified and measurements- cloud seeding- Rainfall and its mechanisms-forms and types of rainfall-Indian Monsoon-southwest monsoon- northeast monsoon-monsoon variability across Manipur and India-Rainfall over India and Manipur.

Unit-IV:

Importance of weather forecasting in Agriculture-weather service to farmers-agricultural seasons-crop weather diagrams and calendars-Crop weather relationships-Role of weather on insect, pest and diseases. Meteorological and Agro-meteorological Stations. Types of agro-meteorological stations. Preparation of Crop Weather Calendar-weather and climate related natural disasters, risk and management- Climate change and global warming-weather modification-Introduction to remote sensing.

Reference books:

1. Das P.K. 1968. The Monsoons.NBT, New Delhi.
2. Khadekar, S.R. 2001. Meteorology, Agromet publishers, Nagpur.
3. Mavi, H.S. 1986. Introduction of Agrometeorology. Oxford & IBH Publishing Co. New Delhi.
4. Bhakta, G.P. 1992. Geography of North-East India. Akashi Book Depot, Shillong.
5. Sachati, A.K. 1985. Agricultural Meteorology- Instruction-cum-practical manual, NCERT, New-Delhi.
6. Varshneya. M.C and BalakrishnaPillai, B. 2003. Text book of Agricultural Metrology. ICAR, New Delhi.
7. Venketaraman, S and Krishnan, A. 1992. Crops and weather. ICAR, New Delhi.
8. Wilsie, P.C. 1961. Crop Adaptation and Distribution. Eurasia Publishing House (P) ltd., New Delhi.
9. Das P.K. 1968. The Monsoons.NBT, New Delhi.
10. Khadekar, S.R. 2001. Meteorology, Agromet publishers, Nagpur.
11. Mavi, H.S. 1986. Introduction of Agrometeorology. Oxford & IBH Publishing Co. New Delhi.
12. Bhakta, G.P. 1992. Geography of North-East India. Akashi Book Depot, Shillong.
13. Sachati, A.K. 1985. Agricultural Meteorology- Instruction-cum-practical manual, NCERT, New-Delhi.
14. Varshneya. M.C and BalakrishnaPillai, B. 2003. Text book of Agricultural Metrology. ICAR, New Delhi.
15. Venketaraman, S and Krishnan, A. 1992. Crops and weather. ICAR, New Delhi.
16. Wilsie, P.C. 1961. Crop Adaptation and Distribution. Eurasia Publishing House (P) ltd., New Delhi.

Paper Title:Agricultural Meteorology-Practical
Paper Code: BVAG-404(P)

Credit: 2
Maximum Marks: 50

1. Site selection of agro met observatory.
2. Measurement of temperature (ambient/soil).
3. Rainfall, evaporation atmospheric pressure, sunshine duration and solar radiation, wind direction and speed and relative humidity.
4. Study of weather forecasting and synoptic charts;
5. Introduction of remote sensing.
6. Record keeping of daily meteorological data.
7. Visit to local met observatory centres.

Paper Title:Agricultural Engineering and Farm Machinery
Paper Code: BVAG-405
Credit: 4
Maximum Marks: 100

Course Outcomes (COs)/Learning Outcomes
The knowledge and skill that the student acquire at the end of each course/paper:
At the end of the course the students will be able to acquire knowledge and/or perform:

CO1	Knowledge ofstatus and sources of farm power in India
CO2	Working principles of I. C. engines
CO3	Knowledge about components, working principle and maintenance of I. C. engines
CO4	Knowledge about tillage, sowing and planting equipment
CO5	Knowledge of plant protection, harvesting and threshing equipment

Unit-I:
Status of farm power in India, sources of farm power. I.C. engines, working principles of I. C.engines, comparison of two stroke and four stroke cycle engines. Components of I.C. engine, I.C. engine terminology and solved problems.
Unit-II:
Familiarization with different systems of I.C. engines: Air cleaning, cooling, lubrication,fuel supply and hydraulic control system of a tractor. Familiarization with power transmission system: clutch, gear box, differential and final drive of a tractor, tractor types, cost analysis of tractor power and attached implement.
Unit-III:
Familiarization with primary and secondary tillage implement, implement for hill agriculture,implement for intercultural operations. Familiarization with sowing and planting equipment,calibration of a seed drill and solved examples.
Unit-IV:
Familiarization with plant protection equipment, familiarization with harvesting and threshing equipment

Reference Book
1. Michel A.M, and Ojha T,P Principle of agricultural Engineering , Vol, Jain Brothers, New Delhi.
2. Kepner R,A, Roy Brainer and Barger E.L, Principle of Farm machinery, CBS Publishers and Distributors, New Delhi.

Paper Title:Agricultural Engineering and Farm Machinery-Practical
Paper Code: BVAG-405(P)
Credit: 2

Maximum Marks: 50

1. Components of I.C. engine.
2. Maintenance of farm tractor.
3. Learning of tractor driving.
4. Operation of power tiller.
5. Implements for hill agriculture.D
6. Different types of tillage implements: mould plough, disc plough and disc harrow.
7. Familiarization with seedcum-fertilizer drills their seed metering mechanism and calibration, planters and transplanter.
8 Familiarization with different types of sprayers and dusters Familiarization with different intercultivationequipment, Familiarization with harvesting and threshing machinery.
9. Field training.

Paper Title:Livestock Farming
Paper Code: BVAG-406
Credit: 4
Maximum Marks: 100

Course Outcomes (COs)/Learning Outcomes
The knowledge and skill that the student acquire at the end of each course/paper:
At the end of the course the students will be able to acquire knowledge and/or perform:

CO1	Role of livestock farming in national economy
CO2	Various management practices of livestock in dairy farming
CO3	Care and management of cattle, buffalo, sheep and goat in livestock farming
CO4	Knowledge of milk constituent and quality
CO5	Identification and management of animal diseases

Unit-I:
Role of livestock in national economy: Management- principles of management, functions of management, tools of management. General management practices in dairy farming-grooming, drying off, control of bad habits, castration, dehorning, trimming, shoeing, identification marks, removing extra teats.
Unit-II:
Cattle and buffalo management- housing of cattle, calf raising, Heifer management, management of pregnant and lactating cow and buffaloes, care and management of cross breed cow, care and management of breeding bull, sheep and goat management- housing of sheep and goat, general management practices.
Unit-III:
Milk Industry: definition of milk, composition of milk, constituent of milk, factors affecting quality and quantity of milk, nutritive value of milk, physico-chemical properties of milk. Clean milk production: source of contamination.
Unit-IV:
Classification of animal diseases: study of major diseases- foot and mouth disease (FMD), anthrax, black quarter (BQ), haemorrhagic septicaemia (HS). Study of parasitic piseases: brucellosis, babesiasis, theleriosis. Diseases of lactating cow: mastitis, dystokia milk fever, prolaps, ketosis. Diseases of Calves: Pneumonia, Calf score, Diarrhoea.

Reference books:
1. A Text Book of Animal Husbandry by G.C. Banarjee
2. A Text Book of Animal Science by. Dr. A.U. Bhikane and Dr. S.B. Kawitkar
3. Advances in Dairy Animal Production by V.D. Mudgal, K.K. Singhal and D.D. Sharma

4. Handbook of animal Husbandry, The I.C.A.R. publication
5. Animal Husbandry & Dairy Science by. Jagdish Prasad.
6. Dairy India Yearbook - 2007 by. P.R. Gupta
7. Farm Animal management and feeding practices in India by Thomas &Shashtri
8. Dairy Microbiology by K.C. Mahanta

Paper Title:Livestock Farming-Practical
Paper Code: BVAG-406(P)
Credit: 2
Maximum Marks: 50

1. Morphology of cattle, buffalo
2. Classification of cattle breeds
3. Study of cattle breeds indigenous and exotic.
4. Hands on training of the students on the overall farm practices of livestock management including cleaning, feeding, watering, grooming, milking, routine healthcare, record keeping, sanitation, housing, fodder production.
5. Visit to cattle farms.

Semester-V

A. General Education (Core Papers)

Paper Title:Environmental Studies
Paper Code: BVAG-501
Credit: 4
Maximum Marks: 100

Course Outcomes (COs)/Learning Outcomes
The knowledge and skill that the student acquire at the end of each course/paper:
At the end of the course the students will be able to acquire knowledge and/or perform:

CO1	Knowledge about the concept of Ecology, ecosystem, biodiversity and its importance for conservation.
CO2	Familiar with the concept of Biodiversity and its importance.
CO3	Knowledge about the importance and significance of natural resources.
CO4	Learn the various forms of industrial and environmentalpollution.
CO5	Conceptualize about the social issues on environmental conservation.

Unit-I:
Environmental studies – meaning, scope and importance. Ecology and concept of ecosystem, meaning of ecology, structure and function of and ecosystem, producers, consumers, decomposers, energy flow in the ecosystem, ecological succession, food chain, food webs and ecological pyramids. Types of ecosystems – structure and functions of forest ecosystem, grass land ecosystem, desert ecosystem, aquaticecosystem.
Unit-II:
Biodiversity and its conservation – introduction, definition, genetic, species and ecosystem diversity, value of biodiversity, biodiversity at global, natural and local levels. India as a mega-diversity nation, Biodiversity hotspots, threats to biodiversity, conservation of biodiversity in in-situ, ex-situ. Natural resources – features, air resources, forest resources, water resources, mineral resources, consequences.

Conservation of natural resources – role of an individual in conservation of natural resources.
Unit-III:
Industry and environmental pollution – soil pollution, air pollution, water pollution, thermal pollution, noise pollution – causes, effects and control measures. Waste management – waste minimization through cleaner technologies, reuse and recycling, solid waste management.
Unit-IV:
Social issues and environment – unsustainable to sustainable development, urban problems related to energy, water conservation, water harvesting, resettlement and rehabilitation of people. Human population and environment – population growth, variation among nations, population explosion, environment and human health, human rights, value education, women and child welfare.

Reference books:
1. Misra S.P. and Pandey S.N., *'Essential environmental studies,'*Ane books India, Newdelhi.
2. Kiran B. Chokkas and others,*'Understanding environment,'* Sage Publications,New Delhi
3. ArumugamN.andKumaresanV.,*'EnvironmentalStudies,'*SarasPublicationsKanyakuamri
4. Benny Joseph,*'EnvironmentalStudies,'*Tata McGraw-Hill Publishing Co.Ltd., NewDelhi.
5. Anjaneyalu,Y.2004,IntroductiontoEnvironmentalScience.BSPublication,Hyderabad, A.P. India
6. ErachBharucha, 2005, Text Book of Environmental Studies for Undergraduate Courses, University Grants Commission, NewDelhi.
7. Vidyasagar R and PrabhuPrasadini 2008, Objective Questions and Glossary in Environmental Science, BS publications,Hyderabad.
8.Gupta, P.K. 2004, Methods in Environmental Analysis – Water, Soil and Air, Agrobios (India),Jodhpur.
9. Agarwal, K.C. 2001, Environmental Biology, Nidi Publ. LtdBikaner.
10. Hawkins R.E., Encylopedia of Indian natural History, Bombay Natural History Society, Bombay(R).

Paper Title:E-Commerce
Paper Code: BVAG-502
Credit: 4
Maximum Marks: 100

Course Outcomes (COs)/Learning Outcomes
The knowledge and skill that the student acquire at the end of each course/paper:
At the end of the course the students will be able to acquire knowledge and/or perform:

CO1	Explain the basic fundamental, advantages and disadvantages of e-commerce.
CO2	Investigate about the various infrastructural requirements for e-commerce business.
CO3	Discuss various models for e-Commerce Process and its techniques.
CO4	Explain the risk associated with e-commerce business.
CO5	Investigate the prospect of e-commerce business to today's business scenario.

Unit-I:
Introduction to E-commerce:Introduction,E-commerceorElectronic Commerce- An Overview, Electronic Commerce– Cutting edge, Electronic CommerceFramework,Evolutionof E-commerce:History of Electronic Commerce,Advantages and Disadvantageof E-commerce, Roadmap of e-commerce inIndia

Unit-II:
E-commerce Infrastructure: Introduction, E-commerceInfrastructure-An Overview, Hardware, Server Operating System, Software, Network Website, Managing the e-Enterprise: Introduction, e-Enterprise,Managingthe e- Enterprise,E-business Enterprise,Comparison between ConventionalDesignand E-organisation, Organisationof Business in ane-Enterprise
Unit-III:
E-Commerce Process Models: Introduction, Business Models, E -business Models Based on the Relationship of Transaction Parties, e-commerce Sales Life Cycle (ESLC) Model, E-Marketing:The scope of E-Marketing,Internet Marketing Techniques
Unit-IV:
Risks of Insecure Systems: Introduction, An Overview of Risks Associated with Internet Transactions, Internet Associated Risk s, Intranet Associated Risks, risks associated with BusinessTransaction Data Transferred betweenTrading Partners, Management of Risk: Introduction, Introduction to Risk Management, Disaster Recovery Plans, Areas of Potential Growth and Future forE-commerce.

Reference books:
1. E-Commerce, An Introduction, Amir Manzoor, lambert academicpublishing
2. E-Commerce, RitendraGoel, New AgeInternational
3. E-Commerce, MamtaBhusryFirewallMedia
4. E-Commerce, P. T. S. J. JOSEPH, PHILearning

B. Ability Enhancement Paper: {BVAG-503A & BVAG-503A(P) / BVAG-503B & BVAG-503B(P) / BVAG-503C & BVAG-503C(P)}

Paper Title:Agro-forestry
Paper Code: BVAG-503A
Credit: 2
Maximum Marks: 50

Course Outcomes (COs)/Learning Outcomes
The knowledge and skill that the student acquire at the end of each course/paper:
At the end of the course the students will be able to acquire knowledge and/or perform:

CO1	Knowledge ofvarious agroforestry systems adopted in India
CO2	Basic knowledge of forestry. Classification and distribution of forests in India
CO3	Planning and maintenance of forest nursery
CO4	Problems of deforestation and remedial measures
CO5	Forest products and forest policy and laws

Unit-I:
Agroforestry – definitions, importance, criteria of selection of trees in agroforestry, different agroforestry systems prevalent in the country, shifting cultivation, taungya, alley cropping, wind breaks and shelter belts, home gardens.
Unit-II:
Forestry - definition, scope and important terminology. Status of forests in India and their role. History of forestry development in India. National and International Forestry Organizations. Distribution of forests andtheir classification.Silviculture of agroforestry trees with special reference to oak, mulberry, bambooetc.
Unit-III:
Concept of nursery, temporary and permanent nursery, criteria for site selection, lay-out and design of beds, type of containers its uses and limitations, sowing techniques, soil mixtures, sowing,manuring,

fertilization in nursery, water management in nursery, seedling protection from environmental and biological agents; nursery disease, pests and their control.
Unit IV
Deforestation - forms, causes and remedial measures. Forest management: growing stock, normal forest, sustained yield, increment and rotation. Forest utilization major and minor forest products. Forest policy and laws.

Reference books:
1. Agroforestry: System and Practices. Sunil Puri, 2007. New India Publing.
2. Agroforestry Theory and Practices. A. J. Ray, 2014. Scientific publishers.
3. Agroforestry: Anecdotal to Modern Science. J.C. Dadar and V.P. Tewari, 2018. Springer
4. Introduction to Forestry by S.R Reddy and C. Nagamani.
5. Introduction to Forestry and Agroforestry by K.T. Parthiban, N.
Krishnakumar and M. Karthick.

Paper Title:Agro-forestry-Practical
Paper Code: BVAG-503A(P)
Credit: 2
Maximum Marks: 50

1. Identification of tree-species.
2. Measurement of tree height, diameter, girth, bark thickness, increment, age and volume.
3. Height measurement of standing trees by shadow method, single pole method and hypsometer. 4. Volume measurement of logs using various formulae.
5. Nursery lay out, seed sowing, vegetative propagation techniques.
6. Silviculturalpractices of some economic forest trees viz., oak, mulberry, bamboo, etc.
7. Visits to forest nursery sites and forest based industries.

Paper Title:Aquaculture
Paper Code: BVAG-503B
Credit: 2
Maximum Marks: 50

Course Outcomes (COs)/Learning Outcomes
The knowledge and skill that the student acquire at the end of each course/paper:
At the end of the course the students will be able to acquire knowledge and/or perform:

CO1	Basic concept of aquaculture and its status in global scenario
CO2	Knowledge about various systems of aquaculture
CO3	Selection of candidate fish species for freshwater, brackish water, inland saline water and marine water aquaculture
CO4	Principles of organic aquaculture
CO5	Various factors affecting fish productivity

Unit-I:
Basics of aquaculture, definition and scope. History of aquaculture: Present global and national scenario. Aquaculture vs Agriculture.
Unit–II:
Systems of aquaculture - pond culture, pen culture, cage culture, running water culture and zero water exchange system. Extensive, semi-intensive, intensive and super intensive aquaculture in different types of water bodies viz., freshwater, brackish water,inland saline and marine water.

Unit-III:
Principles of organic aquaculture. Pre-stocking and post stocking pond management. Carrying capacity of pond, factors influencing carrying capacity. Criteria for selection of candidate species for aquaculture. Major candidate species for aquaculture: freshwater, brackish-water and marine.
Unit-IV:
Monoculture, polyculture and integrated culture systems. Water and soil quality in relation to fish production. Physical, chemical and biological factors affecting productivity of ponds.

Reference books:
1. A Textbook of Aquaculture. KRS SambasivaRao, 2018. Indian Books and Periodicals.
2. Aquaculture and Fisheries. N Arumugam,.Saras Publications.
3. Prospects of Aquaculture. NC Sinha, 2015. Rajesh Publications.
4. Fresh Water Aquaculture. B Ahilan. Daya Publishing House.
5. A Hand book of Fish Farming. AC Agarwal, 2007. Indian Books and Periodicals.
6. A – Z Fisheries and Aquaculture Technology. KD Bhardwaj, 2011. Indian Books and Periodicals.

Paper Title:Aquaculture-Practical
Paper Code: BVAG-503B(P)
Credit: 2
Maximum Marks: 50

1. Aquaculture production statistics- world and India.
2. Aquaculture resources of world and India.
3. Components of Aquaculture farms.
4. Estimation of carrying capacity.
5. Practices on pre-stocking and post stocking management.
6. Growth studies in aquaculture system.
7. Study on waste accumulation in aquaculture system (NH_3, Organic matter, CO_2).
8. Analysis of manure.
9. Visits to aquaculture farms.

Paper Title:Poultry
Paper Code: BVAG-503C
Credit: 2
Maximum Marks: 50

Course Outcomes (COs)/Learning Outcomes
The knowledge and skill that the student acquire at the end of each course/paper:
At the end of the course the students will be able to acquire knowledge and/or perform:

CO1	Knowledge of present status, prospects and classification of poultry farming
CO2	Classification, ingredients, additives, formulation and nutrient value of poultry feeds
CO3	Knowledge about management ofincubation, hatching and breeding of grower.
CO4	Management of poultry diseases and vaccination schedule
CO5	Establishment and management of poultry farm

Unit-I:
Definition of poultry; present status and future prospects of poultry industry; importance of poultry farming and development in India. Origin and classification of poultry based on genetic utility.Economics of poultry production.
Unit-II:

Principal and classification of feed stuffs; system of feeding; feed ingredients for poultry: ration, supplements or feed additives and feed formulation.
Unit-III:
Diversified and modern breeds of poultry ;reproduction in poultry keeping; present day egg and meat production line of poultry ; management in incubation; hatching and breeding of grower and improvement of poultry.

Unit-IV:
Introduction of poultry disease; management of important diseases of poultry; prevention and control (including vaccinations schedule); breeder and hatchery management - different type of selection and upgrading ; poultry flock management - housing and space requirement during their life cycle of poultry.

References books:
1. B. Mahapatra and SC Panda, 1989. Poultry Production. ICAR Press.
2. Jull, M.A. (2003) Successful Poultry management.
3. P.C. Panda, 1995. Egg and poultry. Vikas publishing House.
4. Moreng, R.W. and J.S. Avens, Poultry Science and Production. Reston Publishing Co., Reston, VA.
5. Mack O. north or Donald D. Bell, 1990. Commercial Chicken Production Manual (Fourth edition). Van Nostrand Reinhold – New York.

Paper Title:Poultry-Practical
Paper Code: BVAG-503C(P)
Credit: 2
Maximum Marks: 50

1. Demonstrations, nomenclature and external anatomy of poultry breeds: chicken/ desi chicken, duck and turkey
2. Brief account on nutrient requirement in poultry feeds: protein, carbohydrate, lipids, vitamins and minerals
3. Preparation of feeds - selection of ingredients, feed formulation, grinding, mixing, packing and storage
4. Identification and simple test for quality and candling of eggs
5.Hatchery operations, incubation, hatching equipment and case rearing systems
6. Marketing methods for disposal of eggs and poultry products in different market units.
7. Preparation of organic manures from poultry litter
8. Visit to poultry farms and poultry processing plants

C. Skill Component Papers: Discipline Specific Papers

Paper Title:Crop Production Technology-I (*Kharif*Crops)
Paper Code: BVAG-504
Credit: 4
Maximum Marks: 100

Course Outcomes (COs)/Learning Outcomes
The knowledge and skill that the student acquire at the end of each course/paper:
At the end of the course the students will be able to acquire knowledge and/or perform:

CO1	Basic knowledge of *Kharif*crops
CO2	Requirements and cultural practices for production of*Kharif*crops

CO3	Supervision and production of cereal crops
CO4	Supervision and production of pulses and oilseed crops
CO5	Supervision and production of fibre and forage crops

Unit-I:
Origin, geographical distribution, economic importance, soil and climatic requirements, varieties, cultural practices and yield of *Kharif*crops.
Unit-II:
Production technology of cereals – rice, maize, sorghum, pearl millet and finger millet.
Unit-III:
Production technology of pulses-pigeonpea, mungbean and urdbean and oilseeds- groundnut, and soybean.
Unit-IV:
Production technology of fibre crops- cotton and jute and forage crops-sorghum, cowpea, cluster bean and napier.

Reference books:
1. ICAR. Handbook of Agriculture
2. PAU. Package of Practices for Kharif Crops.
3. ICAR. Text book of Field crops Production-Food grain crops.
4. ICAR. Text book of Field Crops Production- Commercial Crops.

Paper Title:Crop Production Technology-I (*Kharif* Crops)-Practical
Paper Code: BVAG-504(P)
Credit: 2
Maximum Marks: 50

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

Paper Title:Organic Farming and Sustainable Agriculture
Paper Code: BVAG-505
Credit: 4
Maximum Marks: 100

Course Outcomes (COs)/Learning Outcomes
The knowledge and skill that the student acquire at the end of each course/paper:
At the end of the course the students will be able to acquire knowledge and/or perform:

CO1	Knowledge about the concept of sustainable agriculture and related issues
CO2	Various types of alternate agricultural systems
CO3	Strategies for maintaining ecological balance in conjunction with crop production
CO4	Various practices for use of manure, fertilizers, pesticides and alternative practices, and water resource
CO5	Concept and practices of organic agriculture

Unit-I

The concept of sustainability and sustainable development, emerging issues. Sustainable agriculture-concept themes, differences between conventional, sustainable, and alternate agriculture. Various alternate agricultural systems- conventional, sustainable, and alternate agriculture. Alternate agricultural systems- biodynamic farming, natural farming, organic farming, permaculture, homa farming, and other formslimitations. Modernization of agriculture and its relation to sustainability.

Unit-II:

Factors affecting ecological balance and ameliorative measures- Strategies for realizing sustainable agriculture- low vs. high external input agriculture -Natural resource management as a part of sustainable resource management -crop production practices -Basic ecological principles of LEISA - promising LEISA techniques and practices –Good Agricultural Practices(GAP)- GAP certification.

Unit-III:

Improved manure handling - crop residue management - strategic use of chemical fertilizers and pesticides, traps, repellants, water conservation measures for sustainability- water harvesting - ITK and farmer centered techniques and practices. Foliar fertilization.

Unit-IV:

Organic agriculture-history-concepts- philosophy- objectives, opportunities and prioritiesCriticisms-Organic farming and food security-Principles of organic farming. Tools and practices of organic farming: Planned crop rotation, Green manures and cover crops, Manuring and composting, multiple cropping. Biological pest control: Biological control of weed, pest and pathogens; biopesticvides.

Reference books:

1. Ananthakrishnan, T.N. (ed.) 1992. Emerging Trends in Biological Control of Phytophagousinsects.Oxford& IBH, New Delhi.
2. Chhonkar, P.K. and Dwivedi, B.S. 2004. Organic farming and its implications on India's food security.Fertil. News 49(11): 15-18,21-28,31&38.
3. Gaur, A.C. 1982. A Manual of Rural Composting. FAO/UNDP Regional Project Document, FAO, Rome.
4. Howard, A. 1940. An Agricultural Testament. Oxford University, London. Lampin, N. 1990. Organic Farming. Farming Press Books, Ipswitch, U.K.
5. Palaniappan, S.P and Anandurai, K. 1999. Organic Farming- Theory and Practice, Scientific Pub., Jodhpur.
6. Reddy, M.V. (ed.) 1995.Soil organism and Litter decomposition in the Tropics. Oxford &IBH, New Delhi.
7. Singh, S.P. (ed.) 1994. Technology for Production of Natural Enemies, Project Directorate of Biological Control, Bangalore.
8. Trivedi, R.N. 1993. A Text Book of Environmental Sciences, Anmol Pub., New Delhi.
9. Veeresh, G.K., Shivashankar, K. and Singlachar, M.A. 1997. Organic Farming and Sustainable Agriculture, Association for Promotion of Organic Farming, Bangalore.
10. Woomer, PL. and Swift, M.J. 1994. The Biological Management of Tropical Soil Fertility,.S.B.F. & Wiley.

Paper Title:Organic Farming and Sustainable Agriculture-Practical
Paper Code: BVAG-505(P)
Credit: 2
Maximum Marks: 50

1. Preparation of enriched farm yard manure.
2. Preparation of Vermicompost.

3. Study and field application of biofertilizers.
4. Plant protection through bio-agents and traps.
5. Plant protection using pheromones.
6. Visit to an organic farm to study various components and utilization.
7. Raising of crops and ornamental nursery raising organically through nutrient, diseases and pest management.

Paper Title:Seed Technology
Paper Code: BVAG-506
Credit: 4
Maximum Marks: 100

Course Outcomes (COs)/Learning Outcomes
The knowledge and skill that the student acquire at the end of each course/paper:
At the end of the course the students will be able to acquire knowledge and/or perform:

CO1	Knowledge about seed industry in India
CO2	Concepts of seed characters and seed quality
CO3	Characteristics of seed germination, emergence and field establishment
CO4	Various parameters of seed dormancy, seed viability, seed vigour seed deterioration
CO5	Various methods of seed testing including seed health test

Unit-I:
Seed Technology – scope and importance, development of seed industry in India. Seed Act 1966. Intellectual Property Rights, patenting, WTO, Plant Breeders Rights. Difference between seed and grain, categories of agricultural seeds. Seed quality – concept, quality characteristics. Seed development and maturation, accumulation of food reserves in seeds.
Unit-II:
Seed germination – types of seed germination, factors affecting germination, changes in seeds associated with germination, field emergence and stand establishment. Seed viability – difference between seed viability and germination, viability nomograph.
Unit-III:
Seed vigour – concept, factors affecting seed vigour, significance of assessing seed vigour. Seed dormancy – merits and demerits of dormancy in seeds, intensity and duration of dormancy, types of seed dormancy, causes, methods of breaking dormancy, induction of dormancy. Seed longevity and deterioration – orthodox and recalcitrant seeds, factors influencing the life span of seeds, symptoms of seed deterioration, possible causes of seed deterioration, seed invigoration.
Unit-IV:
Seed testing– objectives, development of organisations for seed testing at international and national level, establishment of a seed testing laboratory. Seed health – pathogens, insects and other organisms causing damage to sowing quality of seed and their management.

Reference books:
1. Seed Technology – R.L. Agrawal
2. Principles of Seed Technology – G.M. Kulkarni
3. Structure Development and Reproduction in Angiospeerms – V. Singh, P.C. Pande&D.K.Jain
4. Principles of Seed Science & Technology – L.O. Copeland & M.B. McDonald

Paper Title:Seed Technology-Practical
Paper Code: BVAG-506(P)

Credit: 2
Maximum Marks: 50

1. Identification of different agricultural seeds.
2. Seed structure of typical monocot and dicot seeds.
3. Seed sampling and handling of seed samples.
4. Moisture estimation, Purity analysis, Determination of ODV.
5. Germination test, Seed viability test.
6. Assessment of seed vigour.
7. Genetic purity testing – laboratory methods and field plot test.
8. Seed health testing for pathogens and insect damage.

Semester-VI

A. General Education (Core Papers)

Paper Title:Strategic Management and Business Policies
Paper Code: BVAG-601
Credit: 4
Maximum Marks: 100

Course Outcomes (COs)/Learning Outcomes
The knowledge and skill that the student acquire at the end of each course/paper:
At the end of the course the students will be able to acquire knowledge and/or perform:

CO1	Conceptualize the various concepts of strategic management.
CO2	Practice the implication of various strategic management practices in the business.
CO3	Develop various strategy with respect to existing business competitive environment.
CO4	Acknowledge the various interpersonal relationship from strategic management perspective.
CO5	Implement various strategy in the business to achieve the business objectives.

Unit-I:
Concept, nature, scope and characteristics of strategic management, setting up and balancing the objectives, mission, vision, goals. strategic analysis of functional areas production, marketing, human resources, finance, analyzing corporate capabilities - SWOT.
Unit-II:
Process of strategic planning, formulation of strategy, project life cycle. portfolio analysis : BCG matrix, G.E matrix, directional policy matrix. strategic management - strategic decision making - business level substrategies.
Unit-III:
Generic strategic alternatives: horizontal, vertical diversification, active and passive alternatives. External growth strategy - merger acquisition - amalgamation - joint venture-organizationalstructureandcorporatedevelopment-lineandstafffunctions- evaluation of organization structure - management of change.
Unit-IV:
Implementation of strategy: strategy implementation, leadership, Resources allocation and organizational climate - planning and control of implementation.

Refernece books:
1. David, Strategic Management, Prentice Hall ofIndia.
2. Kazmi, A - Strategic Management - McGraw-HillPublications.

3. William Gluck, Strategic Management and Business Policy, McGrawHill.
4. S.C. Bhattacharya - Strategic Management Concepts & Cases -S.Chand
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Paper Title: Principles of Business Economics
Paper Code: BVAG-602
Credit: 4
Maximum Marks: 100

Course Outcomes (COs)/Learning Outcomes
The knowledge and skill that the student acquire at the end of each course/paper:
At the end of the course the students will be able to acquire knowledge and/or perform:

CO1	Conceptualise the basic concept of microeconomics, understand the demand and supply analysis in business applications.
CO2	Discuss the concept of production and cost structure under different stages of production.
CO3	Explain the pricing and output decisions under various market structure as well as profit decisions.
CO4	Analyse the causes and consequences of different market conditions and macroeconomic environment of business.
CO5	Understand the concepts of trade and development in transitional economies in India, demonstrate the features of Liberalization, Privatization and Globalization.

Unit I:
Introduction-Nature, scope and application of economics in industries, Theory of thefirm and business objectives - Economic, Behavioural and Managerial theories. Law of Demand, Determinants of Demand; Elasticity of Demand; Nature of demand analysis and its forecasting; Law ofsupply.
Unit II:
Production function, Law of variable proportions, Input-Output decisions, Short-run analysis; Long-run function; Short run and long-run cost functions. Empirical estimation of production and costs.
Unit III:
Price-Output Decisions-Price determination under different market conditions; Pricing practices and strategies; Profit measurement and profit policy; Break-Even Analysis, Determinants of investment decision
Unit IV:
Macroeconomic environment, economic transition in India, a brief review- Liberalization, Privatization & Globalization

Reference Books:
1. Peterson, H.C. & W.C. Lewis. Managerial economics. Prentice Hall India, New Delhi, 2004.
2. Maheshwari and Vershney. Managerial Economics, S.Chand&Co., Delhi.
3. Mehta P.L. Managerial Economics, Sultan Chand and Sons, New Delhi.
4. Dholakia RH &Oza.A.L.,*'Micro Economics for Mgt.Students'*, Oxford Uni.Press, New Delhi,2004.

B. Ability Enhancement Paper: {BVAG-603A & BVAG-603A(P) / BVAG-603B & BVAG-603B(P)}

Paper Title:Plant Tissue Culture
Paper Code: BVAG-603A
Credit: 2
Maximum Marks: 50

Course Outcomes (COs)/Learning Outcomes
The knowledge and skill that the student acquire at the end of each course/paper:
At the end of the course the students will be able to acquire knowledge and/or perform:

CO1	Knowledge about components and preparation tissue culture media
CO2	Various techniques used in plant tissue culture
CO3	Knowledge about morphogenesis, organogenesis and somatic embryogenesis
CO4	Various methods of micro-propagation using plant protoplast, plant cell and plant organs
CO5	Types and application of somaclonal variations

Unit-I:
History of plant tissue culture; concept of totipotency; Concept of aseptic culture practices;Components of culture media and role of different macro- and micro- nutrients, vitamins,plant growth regulators and growth supplements; Sterilization techniques.
Unit-II:
Various plant cell, tissue and organ culture techniques and uses; Somatic cell cultures;morphogenesis: organogenesis and somatic embryogenesis.Production of virusfree plants.
Unit-III:
Micro-propagation: *In vitro* grafting, meristem culture;-anther, pollen, embryo, ovule, ovary culture; Protoplast culture and protoplast fusion.
Unit-IV:
Somaclonal variations-epigenic variation, genetic variation, application of somaclonal variations.

Reference books:
1. Bhojwani SS &Razdan MK. 1996. *Plant Tissue Culture: Theory and Practice.*Elsevier.
2. Bhojwani SS &Dantu PK. 2013. *Plant Tissue Culture: An Introductory Text*. Springer 246
3. Dixon RA & Gonzales RA. 2003. *Plant Cell Culture: A Practical Approach*. Oxford University press.
4. Helgason CD & Miller CL. 2005. *Basic Cell Culture Protocols*. 3rd Ed. Humana Press.

Paper Title:Plant Tissue Culture-Practical
Paper Code: BVAG-603A(P)
Credit: 2
Maximum Marks: 50

1. Equipment of plant tissue culture lab.
2. Culture media, types, preparation and sterilization.
3. Selection and surface sterilization of explants.
4. Establishment of callus/cell suspension cultures.
5. Micropropagation; Embryo culture; Anther and pollen culture.
6. Induction of plant regeneration.
7. Hardening and transfer to soil.

Paper Title:Vermicompost Technology
Paper Code: BVAG-603B
Credit: 2
Maximum Marks: 50

Course Outcomes (COs)/Learning Outcomes
The knowledge and skill that the student acquire at the end of each course/paper:
At the end of the course the students will be able to acquire knowledge and/or perform:

CO1	Concept of vermiculture and knowledge about effect of soil types and other soil microorganisms on vermiculture
CO2	Knowledge of indigenous and exotic earthworm species
CO3	Influence of earthworms on soil quality
CO4	Input requirements and maintenance of vermiculture unit
CO5	Harvesting, packaging and marketing of vermicompost

Unit-I:
Definition and concept of vermiculture. Soil: major types (red soil, black soil, alluvial soil). Influence of soil organisms in vermitechnology, litter degradation and decomposition. Pests, parasites and pathogens affecting earthworms.
Unit-II:
Types of earthworms:Endemic and exotic species of earthworms. Ecological classification of earthworms- epigeic, anecic and endogeic forms. Physical, chemical and biological changes caused by earthworms in soil drilospheres and vermicasts.
Unit-III:
Vermicomposting-vermicomposting materials and vermicomposting methods. Small scale and large scale.Vermiculture unit - materials required and maintenance. Recycling of food wastes in vermitechnology.
Unit-IV:
Vermicompost:Harvesting of vermicompost - quality, properties and advantages over chemical fertilizers. Packaging and marketing- cost benefit analysis. Vermiwash and its applications.

Reference books:
1. Vermitechnology, vermiculture, vermicompost and earthworm. ChauhanAvinish. LAP Publishing
2. Earthworm and Solid Waste management. J Jones International Book Distributing Co.
3. Commercial Vermiculture. MS Lekshmy and R. Santhi. Saras Publication.

Paper Title:Vermicompost Technology-Practical
Paper Code: BVAG-603B(P)
Credit: 2
Maximum Marks: 50

1. Identification of earthworm types.
2. Waste material classification, collection, segregation and processing,
3. Bed preparation.
3. Earthworm collection and application on beds, fortnightly mixing of beds.
4. Inspection of beds and watering.
5. Standard composition of vermicompost.
6. Vermicompost collection, Earthworms separation, Air drying of vermicompostandsieving.
7. Pakaging and storing,
8. Vermi-wash production techniques.
9. Field visit with demonstrations

C. Skill Component Papers: Discipline Specific Papers

Paper Title:Agricultural Extension
Paper Code: BVAG-604
Credit: 4

Maximum Marks: 100

Course Outcomes (COs)/Learning Outcomes
The knowledge and skill that the student acquire at the end of each course/paper:
At the end of the course the students will be able to acquire knowledge and/or perform:

CO1	Knowledge about objectives and principles of extension education
CO2	Various extension systems in India during different era
CO3	Concepts and programs of Rural Development and Community Development launched in India
CO4	Capacity building of extension personnel
CO5	Various methods and tools of extension teaching of the target farmers

Unit-I:
Extension education- meaning, definition, scope and process; objectives and principles of extension education; extension programme planning-meaning, process, principles and steps in programme development. Extension systems in India: extension efforts in pre-independence era (Sriniketan, Marthandam, Firka Development Scheme, Gurgaon Experiment, etc.) and post-independence era (Etawah Pilot Project, Nilokheri Experiment, etc.); various extension/ agriculture development programmes launched by ICAR/ Govt. of India (IADP, IAAP, HYVP, KVK, IVLP, ORP, ND, NATP, NAIP, etc.). New trends in agriculture extension: privatization extension, cyber extension/ e-extension, marked-led extension, farmer-led extension, expert systems, etc.
Unit-II:
Rural Development: concept, meaning, definition; various rural development programmes launched by Govt. of India. Community development -meaning, definition, concept and principles, Philosophy of C.D.
Unit-III:
Rural Leadership: concept and definition, types of leaders in rural context; extension administration; meaning and concept, principles and functions. Monitoring and evaluation: concept and definition, monitoring and evaluation of extension programmes; transfer of technology: concept and models, capacity building of extension personnel.
Unit-IV:
Extension teaching methods: meaning, classification, individual, group and mass contact methods, ICT Applications in TOT (News and Social Media), media mix strategies; communication; meaning and definition; Principles and Functions of Communication, models and barriers to communication. Agriculture journalism; diffusion and adoption of innovation: concept and meaning, process and stages of adoption, adopter categories.

Reference Book:
1. Extension Education by A.K. Nayak Singh
2. Agricultural Extension by A.W. van den Ban and H. Staurt Hawkins
3. Panchayti Raj in India by Ravi Goel.

Paper Title:Agricultural Extension-Practical
Paper Code: BVAG-604(P)
Credit: 2
Maximum Marks: 50

1. To get acquainted with university extension system.
2. Group discussion-exercise.
3. Handling and use of audio visual equipments and digital camera and LCD projector.

4. Preparation and use of AV aids, preparation of extension literature-leaflet, booklet, folder, pamphlet news stories and success stories.
5. Presentation skills exercise; micro teaching exercise.
6. A visit to village to understand the problems being encountered by the villagers/ farmers; to study organization and functioning of DRDA and other development departments at district level.
7. Visit to NGO and learning from their experience in rural development.
8. Understanding PRA techniques and their application in village development planning.
9. Exposure to mass media: visit to community radio and television studio for understanding the process of programme production.
10. Script writing, writing for print and electronic media, developing script for radio and television.

Paper Title:Crop Production Technology-II (*Rabi*Crops)
Paper Code: BVAG-605
Credit: 4
Maximum Marks: 100
Course Outcomes (COs)/Learning Outcomes
The knowledge and skill that the student acquire at the end of each course/paper:
At the end of the course the students will be able to acquire knowledge and/or perform:

CO1	Basic knowledge of *Rabi* crops
CO2	Requirements and cultural practices for production of *Rabi*crops
CO3	Supervision and production of cereal and pulses crops
CO4	Supervision and production of oilseed and sugar crops
CO5	Supervision and production of medicinal, aromatic and forage crops

Unit-I:
Origin, geographical distribution, economic importance, soil and climatic requirements, varieties, cultural practices and yield of*Rabi*crops.
Unit-II:
Production technology of cereals and pulses–wheat, barley, chickpea, lentil and peas.
Unit-III:
Production technology of oilseeds and sugar crops-rapeseed, mustard, sunflower andsugarcane.
Unit-IV:
Production technology of medicinal, aromatic and forage crops-mentha, lemon grass, citronella, berseem, lucerne and oat.

Reference Book:
1. ICAR. Handbook of Agriculture
2. ICAR. Text book of Field crops Production-Food grain crops.
3. ICAR. Text book of Field Crops Production- Commercial Crops.
4. G.S.Tomar, Dr.S.P.S.Tomar and Dr. S.N. Khajanji. Science of Crop Production. II Rabi Crops.
5. Suresh Singh Tomar, YagyaDev Mishra and Shailendra Singh Kushwah.Production Technology of Rabi Crops.

Paper Title:Crop Production Technology-II (*Rabi*Crops)-Practical
Paper Code: BVAG-605(P)
Credit: 2
Maximum Marks: 50

1. Identification of weeds in *Rabi*season crops, study of morphological characteristics of *Rab*i crops.

2. Study of yield contributing characters of *Rabi*season crops.
3. Sowing methods of wheat and sugarcane, yield and juice quality analysis of sugarcane.
4. Study of important agronomic experiments of *Rabi*crops at experimental farms.
5. Study of *Rabi*forage experiments, oil extraction of medicinal crops.
6. Visit to research stations and fields of related crops.

Paper Title:Project Formulation and Management
Paper Code: BVAG-606
Credit: 4
Maximum Marks: 100

Course Outcomes (COs)/Learning Outcomes
The knowledge and skill that the student acquire at the end of each course/paper:
At the end of the course the students will be able to acquire knowledge and/or perform:

CO1	Conceptualize the concepts of project management, preparation of business plan, environmental analysis and project identification.
CO2	Investigate feasibility analysis for a business proposal.
CO3	Design procedures and formalities for setting up new enterprise and its legal implications.
CO4	Explain the various incentives and benefits provided by the Government.
CO5	Conduct overall business project appraisal.

Detailed formulation of a project in an assigned entrepreneurship area planning for its implementation and management. Presentation of the project scheme. (Marks allotment: 70 for project formulation; 30 for presentation).

Paper Title:Comprehensive Viva-voce for all subjects taught
Paper Code: BVAG-606(P)
Credit: 2
Maximum Marks: 50

A comprehensive viva-voce of the whole course for assessing knowledge of the student.