ADIKAVI NANNAYA UNIVERSITY: RAJMAHENDRAVARAM

B.Voc Agriculture
Single Major
From 2023-24 (Syllabus-Curriculum)
Course Structure

Year	Semester	Course	Title of the Course	No. of Hrs /Week	No. of Credits
I	I	1	Introduction to Classical Biology	3+2	4
	I	2	Introduction to Applied Biology	3+2	4

ADIKAVI NANNAYA UNIVERSITY: RAJMAHENDRAVARAM

SEMESTER-I

COURSE 1: INTRODUCTION TO CLASSICAL BIOLOGY

Theory Credits: 4 5 hrs/week

Learning objectives

The student will be able to learn the diversity and classification of living organisms and understand their chemical, cytological, evolutionary and genetic principles.

Learning Outcomes

1. Learn the principles of classification and preservation of biodiversity
2. Understand the plant anatomical, physiological and reproductive processes.
3. Knowledge on animal classification, physiology, embryonic development and their economic importance.
4. Outline the cell components, cell processes like cell division, heredity and molecular processes.
5. Comprehend the chemical principles in shaping and driving the macromolecules and life processes.

Unit 1: Introduction to systematics, taxonomy and ecology.

1.1. Systematics – Definition and concept, Taxonomy – Definition and hierarchy.

1.2. Nomenclature – ICBN and ICZN, Binomial and trinomial nomenclature.

1.3. Ecology – Concept of ecosystem, Biodiversity and conservation.

1.4. Pollution and climate change.

Unit 2: Essentials of Botany.

2.1. The classification of plant kingdom.

2.2. Plant physiological processes (Photosynthesis, Respiration, Transpiration, phytohormones).

2.3. Structure of flower – Micro and macro sporogenesis, pollination, fertilization and structure of mono and dicot embryos.

2.4 Mushroom cultivation, floriculture and landscaping.

Unit 3: Essentials of Zoology

3.1. The classification of Kingdom Animalia and Chordata.

3.2 Animal Physiology – Basics of Organ Systems & their functions, Hormones and Disorders

3.3 Developmental Biology – Basic process of development (Gametogenesis, Fertilization, Cleavage and Organogenesis)

3.4 Economic Zoology – Sericulture, Apiculture, Aquaculture

Unit 4: Cell biology, Genetics and Evolution

4.1. Cell theory, Ultrastructure of prokaryotic and eukaryotic cell, cell cycle.

4.2. Chromosomes and heredity – Structure of chromosomes, concept of gene.

4.3. Central Dogma of Molecular Biology.

4.4. Origin of life

Unit 5: Essentials of chemistry

5.1. Definition and scope of chemistry, applications of chemistry in daily life.

5.2. Branches of chemistry

5.3. Chemical bonds – ionic, covalent, noncovalent – Vander Waals, hydrophobic, hydrogen bonds.

5.4. Green chemistry

References

1. Sharma O.P., 1993. Plant taxonomy. 2nd Edition. McGraw Hill publishers.

2. Pandey B.P., 2001. The textbook of botany Angiosperms. 4th edition. S. Chand publishers, New Delhi, India.

3. Jordan E.L., Verma P.S., 2018. Chordate Zoology. S. Chand publishers, New Delhi, India.

4. Rastogi, S.C., 2019. Essentials of animal physiology. 4th Edition. New Age International Publishers.

5. Verma P.S., Agarwal V.K., 2006. Cell biology, genetics, Molecular Biology, Evolution and Ecology. S. Chand publishers, New Delhi, India.

6. Sathyanarayana U., Chakrapani, U., 2013. Biochemistry. 4th Edition. Elsevier publishers.

7. Jain J.L., Sunjay Jain, Nitin Jain, 2000. Fundamentals of Biochemistry. S. Chand publishers, New Delhi, India.

8. Karen Timberlake, William Timberlake, 2019. Basic chemistry. 5th Edition. Pearson publishers.

9. Subrata Sen Gupta, 2014. Organic chemistry. 1st Edition. Oxford publishers.

ACTIVITIES:

1. Make a display chart of life cycle of nonflowering plants.
2. Make a display chart of life cycle of flowering plants.
3. Study of stomata
4. Activity to prove that chlorophyll is essential for photosynthesis
5. Study of pollen grains.
6. Observation of pollen germination.
7. Ikebana.
8. Differentiate between edible and poisonous mushrooms.
9. Visit a nearby mushroom cultivation unit and know the economics of mushroom cultivation.
10. Draw the Ultrastructure of Prokaryotic and Eukaryotic Cell
11. Visit to Zoology Lab and observe different types of preservation of specimens
12. Hands-on experience of various equipment – Microscopes, Centrifuge, pH Meter, Electronic Weighing Balance, Laminar Air Flow
13. Visit to Zoo / Sericulture / Apiculture / Aquaculture unit
14. List out different hormonal, genetic and physiological disorders from the society

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SEMESTER-I

COURSE 2: INTRODUCTION TO APPLIED BIOLOGY

Theory Credits: 4 5 hrs/week

Learning objectives

The student will be able to learn the foundations and principles of microbiology, immunology, biochemistry, biotechnology, analytical tools, quantitative methods, and bioinformatics.

Learning Outcomes

1. Learn the history, ultrastructure, diversity and importance of microorganisms.
2. Understand the structure and functions of macromolecules.
3. Knowledge on biotechnology principles and its applications in food and medicine.
4. Outline the techniques, tools and their uses in diagnosis and therapy.
5. Demonstrate the bioinformatics and statistical tools in comprehending the complex biological data.

Unit 1: Essentials of Microbiology and Immunology

1.1. History and Major Milestones of Microbiology; Contributions of Edward Jenner, Louis Pasteur, Robert Koch and Joseph Lister.

1.2. Groups of Microorganisms – Structure and characteristics of Bacteria, Fungi, Archaea and Virus.

1.3. Applications of microorganisms in – Food, Agriculture, Environment, and Industry.

1.4. Immune system – Immunity, types of immunity, cells and organs of immune system.

Unit 2: Essentials of Biochemistry

2.1. Biomolecules I – Carbohydrates, Lipids.

2.2. Biomolecules II – Amino acids & Proteins.

2.3. Biomolecules III – Nucleic acids -DNA and RNA.

2.4. Basics of Metabolism – Anabolism and catabolism.

Unit 3: Essentials of Biotechnology

3.1. History, scope, and significance of biotechnology. Applications of biotechnology in Plant, Animal, Industrial and Pharmaceutical sciences.

3.2. Environmental Biotechnology – Bioremediation and Biofuels, Bio fertilizers and Bio pesticides.

3.3. Genetic engineering – Gene manipulation using restriction enzymes and cloning vectors; Physical, chemical, and biological methods of gene transfer.

3.4. Transgenic plants – Stress tolerant plants (biotic stress – BT cotton, abiotic stress – salt tolerance). Transgenic animals – Animal and disease models.

Unit 4: Analytical Tools and techniques in biology – Applications

4.1. Applications in forensics – PCR and DNA fingerprinting

4.2. Immunological techniques – Immunoblotting and ELISA.

4.3. Monoclonal antibodies – Applications in diagnosis and therapy.

4.4. Eugenics and Gene therapy

Unit 5: Biostatistics and Bioinformatics

5.1. Data collection and sampling. Measures of central tendency – Mean, Median, Mode.

5.2. Measures of dispersion – range, standard deviation and variance. Probability and tests of significance.

5.3. Introduction, Genomics, Proteomics, types of Biological data, biological databases- NCBI, EBI, Gen Bank; Protein 3D structures, Sequence alignment

5.4. Accessing Nucleic Acid and Protein databases, NCBI Genome Workbench

REFERENCES

1. Gerard J., Tortora, Berdell R. Funke, Christine L. Case., 2016. Microbiology: An Introduction. 11th Edition. Pearson publications, London, England.

2. Micale, J. Pelczar Jr., E.C.S. Chan., Noel R. Kraig., 2002. Pelczar Microbiology. 5th Edition. McGraw Education, New York, USA.

3. Sathyanarayana U., Chakrapani, U., 2013. Biochemistry. 4th Edition. Elsevier publishers.

4. Jain J.L., Sunjay Jain, Nitin Jain, 2000. Fundamentals of Biochemistry. S. Chand publishers, New Delhi, India.

5. R.C. Dubey, 2014. Advanced Biotechnology. S. Chand Publishers, New Delhi, India.

6. Colin Ratledge, Bjorn, Kristiansen, 2008. Basic Biotechnology. 3rd Edition. Cambridge Publishers.

7. U. Sathyanarayana, 2005. Biotechnology. 1st Edition. Books and Allied Publishers pvt. ltd., Kolkata.

8. Upadhyay, Upadhyay and Nath. 2016. Biophysical Chemistry, Principles and Techniques. Himalaya Publishing House.

9. Arthur M. Lesk. Introduction to Bioinformatics. 5th Edition. Oxford publishers.

10. AP Kulkarni, 2020. Basics of Biostatistics. 2nd Edition. CBS publishers.

ACTIVITIES

1. Identification of given organism as harmful or beneficial.

2. Observation of microorganisms from house dust under microscope.

3. Finding microorganism from pond water.

4. Visit to a microbiology industry or biotech company.
5. Visit to a waste water treatment plant.
6. Retrieving a DNA or protein sequence of a gene'
7. Performing a BLAST analysis for DNA and protein.
8. Problems on biostatistics.
9. Field trip and awareness programs on environmental pollution by different types of wastes andhazardous materials.
10. Demonstration on basic biotechnology lab equipment.
11. Preparation of 3D models of genetic engineering techniques.
12. Preparation of 3D models of transgenic plants and animals.

[**NOTE**: In the colleges where there is availability of faculty for microbiology and biotechnology, those chapters need to be handled by microbiology and biotechnology faculty. In other colleges, the above topics shall be dealt by Botany and Zoology faculty]

Course – I & II Model Paper (70 Marks)

SECTION A (Multiple Choice Questions) ***30 x 1 = 30 M***

30 Multiple Choice Questions (Each Unit 6 Questions)

SECTION B (Fill in the blanks) ***10 x 1 = 10 M***

10 Fill in the Blanks (Each Unit 2 Questions)

SECTION C (Very short answer questions) ***10 x 1 = 10 M***

10 Very short answer questions (Each Unit 2 Questions)

SECTION D (Matching) (From 5 Units) ***2 x 5 = 10 M***

1 A
B
C
D
E

2 A
B
C
D
E

SECTION E (True or False) ***10 x 1 = 10 M***

10 True or False (Each Unit 2 Questions)

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SEMESTER – II

COURSE STRUCTURE

Semester	Course Number	Course Name	No. of Hrs/Week	No. of Credits
Semester-II	3	Introduction to Agronomy	3	3
		Introduction to Agronomy Lab	2	1
	4	Introduction to Soil Science	3	3
		Introduction to Soil Science Lab	2	1

SEMESTER-II

INTRODUCTION TO AGRONOMY

Theory **Credits: 3** **3 hrs/week**

Theory: Learning Outcome:

On successful completion of this course, the student will be able to

- **Understand basic principles of Agronomy**
- **Understand the methods of preparing soil ready for raising a crop**
- **Understand the soil, water and plant relationships**
- **Understands the water and nutrient use efficiency, Irrigation and manuring**
- **Understand the weed competition, concepts of weed management**
- **Understand the growth and development of the crops, crop rotation and crop management techniques in problem soils**

COURSE OUTLINES –SYLLUBUS OF THE COURSE

UNIT- I: Importance and scope
Agriculture - Definition
Branches of agriculture

History of agricultural development in the World and India.

UNIT - II: Agro climatic zones
Agronomy - Definition - Importance - Meaning and scope Agro-climatic zones of Andhra Pradesh & India- Crops and their classification- Factors affecting crop production

UNIT - III: Tillage
Types - Objectives - Modern concepts of tillage
Crop establishment methods

UNIT – IV: Manures and fertilizers
Irrigation management - types
Fertilizer application - methods

UNIT – V: Cropping patterns and cropping systems
Weed management- harmful and beneficial effects of weeds- weed control methods
Sustainable agriculture
Integrated farming systems
Organic agriculture

SEMESTER-II

INTRODUCTION TO AGRONOMY (PRACTICAL)

Teaching Hours:2hr/w CREDITS: 01

PRACTICAL SYLLABUS

1. Visit to college farm & Study of farm features and measurements
2. Identification of crops and seeds
3. Study of seed treatment practice
4. Study of tillage implements- practicing ploughing, puddling operations
5. Calculation of the seed rate and fertilized requirements.
6. Different methods of seed sowing and planting.
7. Methods of inter – cultivation operations and implements
8. Fertilizer applications and participation in field operations.

Reference Books

Reddy , S R and Reddi Ramu 5th edition 2016, -Kalyani publishers, Ludhiana.

YELLAMANDA REDDY,T. and SANKARA REDDY ,G.H.(2016) PRINCIPLES OF AGRONOMY. Kalyani publishers, Ludhiana

GOPALA CHANDRA DE.(1989) FUNDAMENTALS OF AGRONOMY. Oxford & IBH Publishing Company Pvt Ltd , New Delhi

GUPTA, O. P. (2011) MODERN WEED MANAGEMENT. Agribios (India) Jodhpur.

SEMESTER-II
INTRODUCTION TO SOIL SCIENCE

Theory Credits: 3 3 hrs/week

Theory: Learning Outcome:

On successful completion of this course, the student will be able to

- **Understand basic principles of Soil science**
- **Understand the soil formation, soil profile, and soil physical properties**
- **Understand the elementary knowledge of soil taxonomy**
- **Understands the problematic soils and their management**
- **Understand soil organic matter composition and its influence on soil micro organisms**

COURSE OUTLINES –SYLLUBUS OF THE COURSE

UNIT - I.INTRODUCTION:

1.1 Definition of soil
1.2 Soil as a Natural Body

UNIT - II.SOIL COMPONENTS:

2.1 Soil air
2.2 Soil water
2.3 organic and inorganic solids

UNIT - III.PHYSICAL PROPERTIES:

3.1 Soil separates, texture, Aggregation and Structural Characters, Temperature, Colour.
3.2 Properties of Soil Mixture, Pore Space, Bulk Density, Particle Density, Aeration.
3.3 Drainage, compaction, Surface area, Soil water relations.

UNIT - IV. MORPHOLOGY OF COLLOIDS & BIOLOGICAL PROPERTIES OF SOIL

4.1 Chemistry of clays, Ionic exchange
4.2 Acidity, alkalinity, PH, and salinity relations, Liming and Acidification.
4.3 Soil Organic matter, C:N relations
4.4 N Transformations, Soil organisms, Sulphur transformation.

UNIT - V. GENESIS AND CLASSIFICATION

5.1 Profile, Soil forming factors

5.2 Soil Survey methods

5.3Soil survey Reports

5.4 Soil distribution, Classification of Systems, Drainage, Erosion: Mechanisms -Control.

SEMESTER-II
INTRODUCTION TO SOIL SCIENCE
(PRACTICALS)

Teaching Hours:2hr/w CREDITS: 01

PRACTICAL SYLLABUS

1. Soil sampling procedures for field and horticultural crops
2. Determination of EC.
3. Determination of PH of soil.
4. Land use, texture bulk density, Definition of Soil Physical properties.
5. Determination of N, P and K of the soil
6. Determination of Sulphur.
7. Fertilizer recommendations.
8. Soil health card, parameters, EC, PH and

their ImportanceReferences

1. Indian Society of Soil Science.2012. Fundamentals of Soil Science. IARI, New Delhi
2. Yawalkar K.S, Agarwal, T.P and Bokde, S 1995. Manures and Fertilizers. Agril. PublishingHouse, Nagpur
3. Samuel Tisdale, Nelson Werner L, Beaton James D and Havlin John L. 2005.
4. Soil Fertility and Fertilizers: An Introduction to Nutrient Management, MacmillanPublishing Co., New York.
5. D. K .Das 2014. Introductory Soil Science. Kalyani Publishers, New Delhi

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MODEL QUESTION PAPER - THEORY

Time: 3 Hours. Max Marks: 70

SECTION – A

Answer any 5 questions. Each question carries 4 marks (5 X 4 = 20M)
(Total 8 questions, questions 1-5 from Units 1-5 & questions 6-8 from any of the units)

1. Unit -I
2. Unit-II
3. Unit-III
4. Unit-IV
5. Unit-V
6. From any Unit
7. From any Unit
8. From any Unit

SECTION – B

Answer all the questions. Each question carries 10 marks. (5 X 10 = 50M)
(Each question (both 'A' or 'B') from each Unit.

9. from Unit I
(OR)
from Unit I

10. from Unit II
(OR)
from Unit II

12. from Unit III
(OR)
from Unit III

13. from Unit IV
(OR)
from Unit IV

14. from Unit V
(OR)
from Unit V

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SEMESTER – III
COURSE STRUCTURE

Semester	Course Number	Course Name	No. of Hrs/Week	No. of Credits
Semester-III	5	Chemistry (Organic and General Chemistry)	3	3
		Chemistry (Practical-III Volumetric Analysis)	2	1
	6	Introduction to Entomology	3	3
		Introduction to Entomology (P)	2	1
	7	Introduction to Plant Pathology	3	3
		Introduction to Plant Pathology (P)	2	1
	8	Fundamentals of Crop Physiology	3	3
		Fundamentals of Crop Physiology (P)	2	1

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SEMESTER – III

Chemistry (Organic and General Chemistry)

Theory Credits: 3 3 hrs/week

Course outcomes: At the end of the course, the student will be able to; Understand and explain the differential behavior of organic compounds based on fundamental

- concepts learnt. Formulate the mechanism of organic reactions by recalling and correlating the fundamental
- properties of the reactants involved Learn and identify many organic reaction mechanism including Free Radical Substitution,
- Electrophonic Addition and Electrophonic Aromatic Substitution. Correlateanddescribethestereochemicalpropertiesoforganiccompoundsand reactions.

UNIT I:

ORGANIC CHEMISTRY Recapitulation of Basics of Organic Chemistry Carbon-Carbon sigma bonds (Alkanes and Cycloalkanes) General methods of preparation of alkanes- Wurtz and Wurtz-Fittig reaction, Corey House synthesis, physical and chemical properties of alkanes, Isomerism and its effect on properties, Free radical substitutions; Halogenations, concept of relative reactivity v/s selectivity. Conformational analysis of alkanes (Conformations, relative stability and energy diagrams of Ethane, Propane and butane) General molecular formulae of cycloalkanes and relative stability, Baeyer strain theory, Cyclohexane conformations with energy diagram, Conformations of monosubstituted cyclohexane.

UNIT II:

Carbon-Carbon pi Bonds (Alkenes and Alkynes) General methods of preparation, physical and chemical properties. Mechanism of E1, E2, E1 cb reactions, Saytzeff and Hofmann eliminations, Electrophilic Additions, mechanism (Markovnikov/Anti Markovnikov addition) with suitable examples, syn and anti-addition; additionofH2,X2, HX. Oxymercuration, demercuration, hydroboration-oxidation, ozonolysis, hydroxylation, Diels Alderreaction,1,2- and1,4-addition reactions in conjugated dienes. Reactions of alkynes; acidity, electrophilic and nucleophilic additions, hydration to form carbonyl compounds, Alkylation of terminal alkynes.

UNIT III:

Benzene and its reactivity Concept of aromaticity, Huckel's rule - application to Benzenoid (Benzene, Naphthalene) and Non - Benzenoid compounds (cyclopropenyl cation, cyclopentadienyl anion and tropylium cation) Reactions - General mechanism of electrophilic aromatic substitution, mechanism of nitration, Friedel- Craft's alkylation and acylation. Orientation of aromatic substitution - ortho, para and meta directing groups. Ring activating and deactivating groups with examples (Electronic interpretation of various groups like NO2 and Phenolic). Orientation of i. Amino, methoxy and methyl groups ii. Carboxy, nitro, nitrile, carbonyl and sulfonic acid groups iii. Halogens (Explanation by taking minimum of one example from each type)

UNIT IV: GENERAL CHEMISTRY

1. Surface chemistry and chemical bonding Surface chemistry Colloids- Coagulation of colloids- Hardy-Schulze rule. Stability of colloids, Protection of Colloids, Gold number. Adsorption-Physical and chemical adsorption, Langmuir adsorption isotherm, applications of adsorption.

2. Chemical Bonding Valence bond theory, hybridization, VB theory as applied to ClF3,Ni(CO)4, Molecular orbital theory -LCAO method, construction of M.O. diagrams for homo-nuclear and hetero-nuclear diatomic molecules(N2,O2,CO and NO). 3. HSAB Pearson’s concept, HSAB principle & its importance, bonding in Hard-Hard and Soft-Soft combinations.

UNIT V:

Stereochemistry of carbon compounds Molecular representations- Wedge, Fischer, Newman and Saw-Horse formulae. Optical isomerism: Optical activity- wave nature of light, plane polarised light, optical rotation and specific rotation. Chiral molecules- definition and criteria (Symmetry elements)- Definition of enantiomers and diastereomers – Explanation of optical isomerism with examples- Glyceraldehyde, Lactic acid, Alanine, Tartaric acid, 2,3-dibromopentane. D,L, R,S and E,Z- configuration with examples. Definition of Racemic mixture – Resolution of racemic mixtures (any 3 techniques)

Co-curricular activities and Assessment Methods Continuous Evaluation: Monitoring the progress of student's learning Class Tests, Worksheets and Quizzes Presentations, Projects and Assignments and Group Discussions: Enhances critical thinking skills and personality Semester-end Examination: critical indicator of student's learning and teaching methods adopted by teachers throughout the semester.

REFERENCE BOOKS: 1. Morrison, R. N. & Boyd, R. N. Organic Chemistry, Dorling Kindersley (India) Pvt. Ltd. (Pearson Education). 2. Finar, I. L. Organic Chemistry (Volume 1), Dorling Kindersley (India) Pvt. Ltd. (Pearson Education). 3. Finar, I. L. Organic Chemistry (Volume 2: Stereochemistry and the Chemistry of Natural Products), Dorling Kindersley (India) Pvt. Ltd. (Pearson Education). 4. Eliel, E. L. & Wilen, S. H. Stereochemistry of Organic Compounds; Wiley: London, 1994. Kalsi, P. S. Stereochemistry Conformation and Mechanism; New Age International, 2005. Practical: 1. Ahluwalia, V.K. & Aggarwal, R. Comprehensive Practical Organic Chemistry: Preparation and Quantitative Analysis, University Press (2000). 2. Ahluwalia, V.K. & Dhingra, S. Comprehensive Practical Organic Chemistry: Qualitative Analysis, University Press (2000). 3. Furniss, B.S.; Hannaford, A.J.; Smith, P.W.G.; Tatchell, A.R. Practical Organic Chemistry, 5th Ed., Pearson (2012) Additional Resources: 1. Solomons, T. W. G.; Fryhle, C. B. &Snyder, S. A. Organic Chemistry, 12th Edition, Wiley. Bruice, P. Y. Organic Chemistry, Eighth Edition, Pearson. 2. Clayden, J.; Greeves, N.&Warren, S. Organic Chemistry, Oxford. Nasipuri, D. Stereochemistry of Organic Compounds: Principles and Applications, Third Edition, NewAge International.

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SEMESTER-III

INTRODUCTION TO ENTOMOLOGY

Theory | Credits: 3 | 3 hrs/week

Learning Out Comes:
After completion of this course the students are able to

1. Understand Insect classification to some extent by taking phylum Arthropoda as anexample
2. Understand basics of insect taxonomy and their arrangement
3. Understand basics insect ecology, factors effecting insect ecology such as biotic, abioticand environmental
4. Understand basic concepts of pest forecasting
5. Understand basics of IPM-different aspects of IPM which is an important concept.

Unit I: History and importance

History of Entomology in India; Position of insects in the animal kingdom and their relationshipwith other classes of Arthropoda; Reasons for insect dominance.

Unit II: Morphology

General organization of insect body wall - structure and function, cuticular appendages, molting; Body regions - insect head, thorax and abdomen, their structure and appendages.

Unit III: Anatomy and physiology

Digestive, excretory, respiratory, circulatory, nervous and reproductive systems in insectsin brief.

Unit IV: Taxonomy of Apterygota and Exopterygota

Insect systematics; distinguishing characters of agriculturally important orders and families of Hexapoda. Characters of Apterygota, Exopterygota (Ephemeroptera, Odonata, Orthoptera, Phasmida, Dictyoptera, Embioptera, Dermaptera, Hemiptera, Isoptera, Psocoptera, Mallophaga, Thysanoptera and Siphunculata).

Unit V: Taxonomy of Endopterygota Distinguishing characters of agriculturally important familiesof Lepidoptera, Coleoptera, Diptera, Hymenoptera, Siphonaptera, Neuroptera and Strepsiptera.

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SEMESTER-III
INTRODUCTION TO ENTOMOLOGY

Practical | Credits: 1 | 2 hrs/week

a. Observations on external features of grasshopper / cockroach,
b. Methods of insect collection, preservation – Preparation of Riker mount.
c. Types of insect head, antenna, mouth parts – Structure of thorax.
d. Types of insect legs, wings and their modifications – wing coupling.
e. Structure of abdomen, and its modifications.
f. Metamorphosis in insects – immature stages in insects.
g. Study of digestive and reproductive systems of grasshopper / cockroach –
h. Observing the characters of agriculturally important orders and families.

REFERENCES:

1. Vasantharaj David, B. and Rama Murthy V.V. 2016. Elements of Economic Entomology, Popular Book Depot, Coimbatore.
2. Vasantharaj David, B and Aanathakrishnan, T.N. 2006. General and Applied Entomology. Tata McGraw-Hill Publishing House, New Delhi.
3. Metcalf, R.L. and Luckman, W.H. 1982. Introduction to Insect Pest Management. Wiley Inter Science Publishing, New York.
4. Atwal, A. S. and Bains, S.S. 1989. Applied Animal Ecology. Kalyani Publishers, New Delhi
5. Yazdani, S.S. and Agarwal,M.L.1979. Elements of Insect Ecology. Narosa Publishing House,New Delhi.
6. Dhaliwal, G.S. and Ramesh Arora 2001. Integrated Pest Management: Concepts and Approaches, Kalyani Publishers Ludhiana
7. Gautam, R. D. 2008. Biological Pest Suppression. Westville publishing House New Delhi
8. Larry P Pedigo and Marlin E Rice. 2009. Entomology and Pest Management. Prentice Hall of India Private Ltd., New Delh

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SEMESTER-III
INTRODUCTION TO PLANT PATHOLOGY

Theory Credits: 3 3 hrs/week

Learning Out Comes:

After completion of the course the students are able to

1. understand the importance of plant diseases, scope and objectives of plant pathology
2. understand the importance of disease-causing organisms, economic loss to the crop and economic threshold limits (ETL)
3. understand the basic aspects of pathogen morphology, propagation methods
4. understand the identification of diseases and casual organisms based on the symptoms

UNIT 1: Introduction to plant diseases and their causal organisms History, Importance of plant diseases, scope and objectives of Plant Pathology. Important plant pathogenic organisms, Classification of Plant Diseases Binomial system of nomenclature, rules of nomenclature

UNIT 2 : Fungi

2.1 Fungi: General characters, definition of fungus, somatic structures,
2.2Types of fungal thalli, fungal tissues, modifications of thallus,

2.3Reproduction (asexual and sexual)

UNIT 3 :

1. Bacteria and Mollicutes Bacteria – General Characters, Classification of plant pathogenic bacteria
2. Important plant bacterial diseases and their causal agents
3. Mollicutes :Phytoplasm and Spiroplasma – General characters and important Diseases and vectors

UNIT4 : Plant Viruses

Fastidious vascular Bacteria – general characters and important diseases and vectors
Viruses: General characters of plant viruses, nature, architecture

Symptoms of various viral diseases, transmission of plant viruses.

Important plant viral diseases and their vectors.

UNIT 5: Viroids, phanerogamic plant parasites and plant parasitic nematodes. Viroids – General characters and important diseases

Phanerogamic plant parasites – general characters, propagation, survival and their hosts Plant parasitic nematodes–general characters and important plant parasitic nematodes.

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SEMESTER-III
INTRODUCTION TO PLANT PATHOLOGY

Practical Credits: 1 2 hrs/week

PRACTICALS:

1. Study of lab equipments.
2. Preparation of PDA (Potato Dextrose Agar).
3. Preparation of NA (Nutrient Agar).
4. General study of different structures of fungi.
5. Study of symptoms of various plant diseases.
6. Staining and identification of plant pathogenic bacteria.
7. Study of phanerogamic parasites.
8. 30 Herbarium of plant diseases caused by fungi, bacteria and viruses.

References:

1. Agribios, G.N. 2005.Plant Pathology. Elsevier Academic Press, New York.
2. Chaube, H.S. and Ramji Singh. 2001. Introductory Plant Pathology. International Book Distribution Co., Lucknow. 136
3. Mehrotra, R.S. 1980. Plant Pathology. Tata McGraw-Hill Publishing Co. Ltd., New Delhi.
4. Singh, R.S. 2002. Introduction to Principles of Plant Pathology. Oxford & IBH Publ. Co. Pvt. Ltd., New Delhi.
5. Vidyasekharan, P. 1993. Principles of Plant Pathology. CBS Publishers and Distributors, New Delhi.

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SEMESTER-III

FUNDAMENTALS OF CROP PHYSIOLOGY

Theory Credits: 3 3 hrs/week

Learning out comes:

Crop physiology is a very important subject that reveals the various aspects of growth of the plants and its dynamics. After completion of this course the student learns to understand

1. the process of germination, different phases of germination of the seed and plantletgrowth
2. water absorption and distribution to various parts of the plant, transpiration andevaporation
3. Nutritional intake, effects of various important nutrients and their deficiency symptoms nutrient uptake mechanisms; assimilation of mineral nutrients: nitrate, ammonium,
4. Able to identify deficiency of nutrients based on symptoms and behavior of plants
5. The seed dormancy, types, methods to overcome the same

Lecture outlines

UNIT 1

1. Introduction to Crop Physiology and its importance in Agriculture.
2. Metabolic changes during seed development - Physiological maturity, harvestable maturity
   - Indices of physiological maturity in crops - Seed germination - Metabolic changes during seed germination.
3. Growth and Development - Definition - Growth analysis - Growth parameters - Definitions and mathematical formulae
4. Absorption of water - Diffusion and osmosis - water potential and its components - Importance of water potential – Active and passive uptake of water – Stomatal complex – Transpiration - Water use efficiency of C3, C4 and CAM plants –

UNIT 2

1. Photosynthesis – Reactions of photosynthesis – Energy synthesis – Principle of light absorption by plants – Light reactions - Cyclic and non cyclic photophosphorylation – CO_2 fixation – C3 and C4 pathways – Significance of C4 pathway – CAM pathway and its significance – Photorespiration and its significance – Photosynthetic efficiency of C3, C4 and
2. CAM plants - Factors affecting photosynthesis (light, CO_2, temp and water stress) - Relationship of photosynthesis and crop productivity.
3. Respiration – Energy balance – Significance of respiration – Oxidative Pentose Phosphate Pathway (OPPP) and its significance – Growth respiration and maintenance respiration – Alternate respiration – Salt respiration – Wound respiration.

UNIT 3

1. Lipid metabolism – Biosynthesis of fatty acids in plastids – Functions of lipids - Significance of lipids in plant metabolism.
2. Physiology of flowering – Photoperiodism and flowering – Importance of photoperiodism – Classification of plants based on photoperiodic responses – Perception of photoperiodicstimulus – Biological clock – Phytochrome – Flowering hormones – Vernalization and flowering – importance of vernalization in agriculture.

UNIT 4

1. Plant growth regulators – Auxins – Occurrence, transport, biosynthesis, mode of action and physiological roles – Commercial uses.– Gibberellins – occurrence, transport, biosynthesis, mode of action and physiological roles – Commercial uses
2. Cytokinins – Occurrence, transport, biosynthesis, mode of action and physiological roles – commercial uses –
3. ABA – Occurrence, transport, biosynthesis, mode of action and physiological roles – Commercial uses –

UNIT 5

1. Ethylene – Occurrence, transport, biosynthesis, mode of action and physiological roles – Commercial uses.
2. Senescence and abscission – Definition – Classification of senescence – Physiological and biochemical changes that occur during senescence - Prevention of leaf and flower senescence – Abscission and its relationship with senescence.
3. Fruit ripening - Climacteric and non climacteric fruits – Metabolic changes during fruit ripening - Hormonal regulation of fruit ripening – Ripening induction and ripening inhibition – Use of hormones in increasing vase life of flowers.

REFERENCE BOOKS:

1. GOPALA CHANDRA DE.(1989) FUNDAMENTALS OF CROP PHYSIOLOGY. Oxford& IBH Publishing Company Pvt Ltd , New Delhi

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SEMESTER – IV

COURSE STRUCTURE

Semester	Course Number	Course Name	No. of Hrs/Week	No. of Credits
Semester-IV	1	Agronomy of Field Crops	3	3
		Agronomy of Field Crops Practicals	2	1
	2	Manures, Fertilizers & Soil Fertility Management	3	3
		Manures, Fertilizers & Soil Fertility Management Practicals	2	1
	3	Agricultural Economics & Farm Management	3	3
		On Job Training	2	1

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SEMESTER – IV
AGRONOMY OF FIELD CROPS

Theory 3 hrs/week

Learning out comes:

This course deals with the actual crop husbandry aspects of various important crops. After completion of the course the students should be in a position to

1. Raise the crops independently following the package of practices for higher yields

2. Selection of the crops, varieties\hybrids

3. Preparationof land,irrigation and drainage channels etc.,

4. Harvesting of crop at right time, processing and storage

5. How to avoid losses at all stages of crop growth due to pests, diseases and nutritional disorders

Syllabus \ course outlines

UNIT-I: PACKAGE OF PRACTICES TO RAISE THE CEREALS: Rice, wheat.

UNIT-II: : PACKAGE OF PRACTICES TO RAISE THE MILLETS : Maize, sorghum, Pearl millet, Finger millet, Proso millet, Kodo millet, Foxtail millet, Little millet, Barnyard millet

UNIT-III: : PACKAGE OF PRACTICES TO RAISE THE PULSES: Pigeon pea, Green gram, Black gram, Bengal gram, Peas, Horse gram, Cowpea

UNIT-IV: : PACKAGE OF PRACTICES TO RAISE THE OIL SEEDS: Ground nut , Sesame, Sunflower, Castor, Rape seed, mustard, safflower, niger, Coconut and oil palm

UNIT-V: :PACKAGE OF PRACTICES TO RAISE THE SUGAR & FIBER CROPS: Sugarcane, Sweet sorghum, Cotton, Jute, Mestha, Sunhemp and other crops : PACKAGE OF PRACTICES TO RAISE THE OTHER CROPS AND FODDER CROPS:: Tobacco, Fodder sorghum, cowpea, Napier, Lucerne, Berseam AND OATS

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Semester – IV
AGRONOMY OF FIELD CROPS
(PRACTICALS)

Credits: 1 Teaching Hours:2

1. Identification of cereals, millets, pulses, oil seed, sugar and fiber crops in the crop Cafeteria.
2. Practicing various nursery types and main field preparation for field crops.
3. Acquiring skill in different seed treatment techniques in important field crops.
4. Estimation of plant population, seed rate and fertilizer requirement for important field
5. Acquiring skill in field preparation, sowing and manuring of crops under pure and intercropping situations for field crops.
6. Acquiring skill in using seed drill for sowing operations.
7. Observations on growth parameters of cereals, millets, pulses, green manures and forage
8. Study on yield parameters and estimation of yield in field crops.
9. Working out cost and returns of important cereals, millets and pulses.
10. Collection of seeds of field crops.

Reference Books

1. Reddy , S R and Reddi Ramu 5th edition 2016, Agronomy of Field CropsKalyani , Ludhiana.
2. Chidda Singh, singh ,P and Singh R, Modern Techniques of Raising field cropsoxford publishing house, New Delhi.

3 Rajendra Prasad 2004 text book of Field Crop Production Volume i, Volume ii4 Panda S C 2014 Agronomy of Fodder a forage crops, kalyani publishers Ludhina

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Semester – IV

MANURES, FERTILIZERS AND SOIL FERTILITY MANAGEMENT

Theory 3 hrs/week

Learning Out Comes:

After the completion of the course, the students should be able to

1. understand the essential nutrients for the crop growth, their deficiency symptoms and remedial measures

2. Understand the methods of manufacture of urea, ammonium sulphate, SSP, DAP, MOP and SOP. Complex, mixed fertilizers, customized/Specialty fertilizers – Water soluble fertilizers, liquid fertilizers.

3. Understand various methods of fertilizer application

4. understand the concepts of INM (integrated nutrient management), STCR, IPNS, SSNM (Site Specific Nutrient Management) and RTNM Syllabus of the course:

Unit–I : Essential Nutrients Soil fertility and productivity-Essential nutrients – functions, deficiency and toxicities. Concepts and methods of soil fertility evaluation. Nutrient Dynamics Nutrients – sources, forms, mobility, transformations, fixation, losses and availability of nitrogen, phosphorus, potassium, calcium, magnesium, sulphur, iron, manganese, zinc, copper, boron, molybdenum, nickel, chloride in soils – Beneficial elements – Nutrient interactions.

Unit–II : **Classification of Fertilizers Fertilizers** – Definition and classification, sources, properties and reactions of primary, secondary and micro nutrient fertilizers in soil – Manufacture of urea, ammonium sulphate, SSP, DAP, MOP and SOP. Complex, mixed fertilizers, customized/Specialty fertilizers – Water soluble fertilizers, liquid fertilizers. Micro nutrient mixtures and chelated micronutrients – Preparation, characteristics and compatibility – Fertilizer Control Order (FCO). Manures – classification, nutrient contents. Composting techniques.

Unit–III : **Application Methods Methods of fertilizer application** – Seed coating, palletization, seedling dipping – Nutriseed pack – Soil Application – Foliar spray – Fertigation – water soluble fertilizers, fertigation scheduling (Fertilizer – water interaction, fertilizer solubility, comparison of fertilizer application methods).

Unit–IV : **Nutrient Management Nutrient management concepts** – INM, STCR, IPNS, SSNM and RTNM.Nutrient use efficiencies of major and micronutrients and enhancement techniques (Soil, Cultural and Fertilizer strategies).Soil health – Quality indices and their management – Long term effect of fertilization on soil.

Unit–V: **Compost and composting- Green manures**- Definitions of penning -Introduction and importance of organic manures- Bulky organic manures- Different methods of composting including the starters and raw materials.

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Semester – IV

MANURES, FERTILIZERS AND SOIL FERTILITY MANAGEMENT (PRACTICALS)

Credits: 1 **Teaching Hours:2**

PRACTICALS:

1. Introduction to analytical instruments an principles-spectrometry and flame photometry
2. Estimation of available N in soils
3. Estimation of available P in soils
4. Estimation of available K in soils
5. Estimation of available S in soils
6. Estimation of available Ca and Mg in soils
7. Estimation of available Zn in soils
8. Basic of plant analysis and estimation on N in plant samples
9. Estimation of P in plant samples
10. Estimation of K&S in plant samples
11. Identification acid radicals in fertilizers / salts
12. Identification of basic radicals in fertilizers / salts
13. Estimation of N in Ammonium sulphate
14. Estimation of N in Urea and FYM
15. Estimation of water soluble P2Os SSP
16. Estimation of K Muriate of potash or Sulphate of potash by using flame photo meter.

References

1. Indian Society of Soil Science.2012. Fundamentals of Soil Science. IARI, New Delhi

2. .Yawalkar K.S, Agarwal, T.P and Bokde, S 1995. Manures and Fertilisers. Agril. Publishing House, Nagpur

3. Samuel Tisdale, Nelson Werner L, Beaton James D and Havlin John L. 2005. Soil Fertility and Fertilizers: An Introduction to Nutrient Management, Macmillian Publishing Co., New York.

4. D. K .Das 2014. Introductory Soil Science. Kalyani Publishers, New Delhi

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Semester – IV

AGRICULTURAL ECONOMICS & FARM MANAGEMENT

Theory 3 hrs/week

Theory: Learning Outcome:

On successful completion of this course, the student will be able to

• Understand basic principles of Agricultural economics. How it is different from normal economics

• Understand the basics of demand, supply, and consumer's equilibrium

• Understand the elementary knowledge of Production , market structure, market dynamics and Distribution theory

• Understands the fundamental concepts of public finance, agriculture taxation , VAT, GST

• Understand the roles of money, banking, credit, price index credit and role of credit policy

COURSE OUTLINES –SYLLUBUS OF THE COURSE

UNIT I: Economics – meaning – definitions – subject matter of economics – traditional approach – Modern approach – microeconomics and macroeconomics- Agricultural economics – definitions – meaning – importance of agricultural economics-branches of agricultural economics - Agricultural production economics – meaning – definitions –Farm management – meaning– scope – definitions – objectives. ; Agricultural marketing – meaning – definition – importance of agricultural marketing. Basic terms and concepts in economics – goods and services – free and economic goods, utility. Value – definition – characteristics; price – meaning; wealth – meaning – attributes of wealth – Wants – meaning - characteristics of human wants. Law of diminishing marginal utility – statement – assumptions of law – explanation –limitations of the law – importance- Law of equi-marginal utility – meaning – assumptions – explanation of the law limitations of the law – practical importance

UNIT 2: Consumer's surplus – meaning – assumptions – explanation – difficulties in measuring consumer's surplus – importance. Demand – meaning – definition – types of demand – income demand, price demand and cross demand Demand schedule – demand curve – Law of demand – Elasticity of demand – meaning – elastic and inelastic demand – kinds of elasticity of demand. 3.Price elasticity – income elasticity and cross elasticity of demand – practical importance of elasticity of demand. Supply – meaning – definition – Law of supply – supply schedule – supply curve Increase and decrease in supply – contraction and extension of supply – factors affecting supply -Elasticity of supply – kinds of elasticity of supply. Markets – definition – essentials of market – classification of market structure – perfect and imperfect markets Characteristics of monopolistic competition – monopoly and oligopoly.

UNIT 3: National income – concepts of national income – gross domestic product, gross national product, net national product, net domestic product -Methods of measurement of national income – product method, income method and expenditure method. Public finance – meaning – role and importance of public finance – functions of the government – differences between public finance and private finance Public revenue. Tax – meaning – classification – direct and indirect taxes – methods of taxation – proportional, progressive, regressive and degressive taxation, agricultural taxation -other types of taxation – Value Added Tax (VAT) - Canons of taxation Public expenditure – social and economic balanced regional growth, development of agriculture and industry, exploitation and development of mineral resources and subsidies and grants to local governments, and exports .

UNIT 4: Inflation – meaning – definition – related concepts of inflation – deflation, disinflation, stagflation and reflation. Measurement of inflation - consumer price index, wholesale price index, producer price index and GDP deflator. Types of inflation – demand pull and cost push inflation – comprehensive and sporadic inflation – suppressed and repressed inflation – creeping, walking, running and galloping inflation – markup inflation- Causes of inflation.

UNIT 5: Factors causing increase in demand – increase in money supply, increase in disposable income, increase in public expenditure, increase in consumer spending. Cheap monetary policy, deficit financing and increase in exports, factors causing shortage of supply – shortage of factors of production, industrial disputes, natural calamities, artificial scarcities, increase in exports, lop-sided production Law of diminishing returns and international factors Remedial measures to control inflation – monetary measures – credit control, demonetization of currency and issue of new currency – fiscal measures-

Semester – IV

OJT (ON JOB TRAINING)

CONTENT	EVALUATION	MARKS
FIELD TRIPS	3X5	15
PROJECT REPORT/ INDUSTRIAL OR INSTITUTE TRAINING& SEMINAR	15+5	20
FIELD COMPONENTS	10X1	10
VIVA VOCE	-	05
TOTAL		50

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Semester – IV
MODEL PAPER
AGRONOMY OF FIELD CROPS

Time: 3 Hours Maximum: 70 Marks

SECTION – A

Answer any FIVE questions. Each question carries equal marks. 5x4M=20M

1. Differentiate between Corchorus capsularis & Corchorous Olitorius.
2. Explain about Sorghum effect.
3. Write about Retting process of Jute.
4. Write down the Nutritional values of Bajra & finger millet
5. Classification of wheat with scientific names
6. Write briefly about different types of nurseries practiced in Rice.
7. Write down some varieties of Wheat, Maize, Sunflower, Cotton & Sorghum.
8. Write down common names, scientific names and their origins of all major & minor millets.

SECTION – B

Answer All the questions. Each question carries TEN marks (5x10M = 50)

9.a) Write down the importance of pulses in India.

OR

b) Write down the importance of oilseeds in India.

10.a) Write about SRI Method of rice cultivation.

OR

b) Write about all planting methods of sugarcane.

11.a) Write general package of practices of millets.

(OR)

b) Write general package of practices of oilseeds.

12.a) Write about nutrient management of Rice, wheat & Maize.

OR

b) Write about nutrient management of Groundnut, Cotton & Sunflower.

13.a) Write Seed rate, souring, nutrient management, water Management, Weed Management, harvesting & yield of groundnut.

OR

b) Write seed rate, souring, nutrient Management, Water Management, Weed Management, harvesting & yield of Rice.

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Semester – IV
MODEL PAPER
MANURES, FERTILIZERS & SOIL FERTILITY MANAGEMENT

Time: 3 Hours **Maximum: 70 Marks**

SECTION – A

Answer any FIVE questions. Each question carries equal marks. 5x4M=20M

1. Give formula for Nutrient use efficiency (NUE) & Nutrient requirement (NR).
2. Write about FCO with specifications of urca.
3. Explain the factors affecting for ammonification of Nitrogen.
4. Explain Sulphur cycle with suitable diagram.
5. Explain briefly about DRIS.
6. What is meant by INM & STCR and explain it briefly.
7. Write about soil application, foliar spray of fertilizers and explain about fertigation
8. Write transformations & fixation of phosphorus & Potassium.

SECTION – B

Answer All the questions. Each question carries TEN marks (5x10M = 50M)

9. a) Write functions of all essential nutrients.

OR

b) Write definition of toxicity symptoms of all essential.

10. a) Differentiate between manures & Fertilizers

(OR)

b) Differentiate between Bulky & Conc. Organic manure.

11. a) Define manures & Write down the classification of manures.

(OR)

b) Define compositing & Write about different methods of compositing.

12.a) Explain different methods of fertilizer applications with suitable tree diagram.

OR

c) Write about classification of nitrogenous, Phosphorus & Potassium with suitable examples.

13. a) Write about soil health and the parameters responsible for assessment of soil health.

OR

b) Write about sources, forms, mobility, transformations, fixation availability of nitrogen.

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Semester – IV
MODEL PAPER
AGRICULTURE ECONOMICS & FARM MANAGEMENT

Time: 3 Hours **Maximum: 70 Marks**

SECTION-A

Answer any FIVE Questions. Each carries equal Marks 5x4M=20M

1. Define Economics, Macro Economics and Micro Economics?
2. What is Demand? Explain about The Types of Demand?
3. What is Elastic and Inelastic Demand? Explain The Types of Elasticity of Demand?
4. Explain Increasing, Decreasing, constant Law of Return? With Examples?
5. Write the definitions of Monopoly, Duopoly, Monopoly Duopoly and oligopoly With Examples?
6. Define inflation and deflation? Explain Demand pull and cost push Inflation?
7. What is the Meaning of Economic system? Explain about the types of Economic systems
8. What is Economic Planning? Discuss the Importance and Elements of economic planning?

SECTION – B

Answer the all questions. Each carry ten marks 5x10M=50M

9 a) Write a detailed note on Law of Diminishing Marginal and statement, assumption and limitation

OR

(b) Explain Law of Equi Marginal utility, importance, assumption and limitation?

10 (a) Explain the different kinds of elasticity of demand? and their affecting factors?

OR

(b) What is the Prediction Process? Explain factor of Production, and input-output relationship of production process

11 (a) What is Elasticity of supply? Explain kinds of Elasticity of supply?

OR

(b) Explain differences between public finance and private finance?

12 (a) What is canon of taxation? And explain Adam Smith s and other canons of taxation?

OR

(b) What is per Capital Income? And Explain the different compacts included in the National Income

13. (a). Write the Meaning of capitalism ,Socialism and Mixed Economics? And its Characteristic features

OR (b) Explain the Five-Year Plans and their Objectives and explain NITI Ayog