Fundamentals of Horticulture	**Credit hours: 3(2+1)**

Theory:

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

Practical:

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

References:

- Chaddha. K.L. and Rajendra Gupta. 1995. Advances in Horticulture Vol.-II Medicinal andAromatic Plant. Malhotra Publishing House, New Delhi.
- Green House Management. A Training Manual of International Horticulture Innovation and Training,Centre, Durgapura, Jaipur.

Silviculture and Forestry	**Credit hours: 2(1+1)**

Theory:

Definition of Forest and Forestry, importance, History, Forestry Education and Research in India, various branches in forestry. National Forest Policy of 1894, 1952, 1988: Indian Forest Act-1927: Karnataka Tree Preservation Act: Forest Conservation Act-1980: The Environment (Protection) Act-1986: Indian Wildlife Preservation Act-1972: Amendments to Environment (Protection) Act-1999. Forest wealth in India: Forest productivity. Deforestation: Various causes and implications, desertification, aforestation, reforestation.

Indian wildlife and management. National parks and sanctuaries, endangered species; Forest ecosystem, natural forests and their formation, succession and zonation, limiting factors: climax vegetation, types of natural forests and their distribution. Food chain, natural forests, V/s man-made forest.

Social forestry and its branches: Extension forestry, urban forestry, recreation forestry. Farm-forestry: Agro-forestry methods, woodlot system etc., and their management, windbreaks and shelterbelts: different types of waste lands and their reclamation through afforestation and joint forest management.

Practicals:

Identification of important trees, seeds and seedlings: Study of nursery techniques-Trench and mound plantation, pit plantation: Study of different types of plantations: Visit to agro-forestry and farm forestry plots: Measurement of volume of standing trees: Study of wood formation: study of wood specimens and non-timber forest products. Visit to a nearby National Park and forest.

Elements of Genetics	**Credit hours: 2(1+1)**

Theory:

Pre and Post Mendelian concepts of heredity, Mendelian principles of heredity, Cell division – mitosis, meiosis, Probability and Chi-square.Dominance relationships, gene interaction.

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

Practical:

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

References:

- Singh, P. 2006. Elements of genetics. Kalyani Publishing House, New Delhi.
- Singh, B.D. 2001.Genetics. Kalyani Publishing House, New Delhi.
- Shekhawat, A.S. and Tripathi, B.K., 2009. A practical manual on Element of Genetics. Publish by, College of Agriculture, Bikaner.

Fundamentals of Plant Biochemistry and Biotechnology Credit hours: 3(2+1)

Theory :

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

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

Practical:

Preparation of solution, pH & buffers, Qualitative tests of carbohydrates and amino acids.Quantitative estimation of glucose/ proteins. Titration methods for estimation of amino acids/lipids, Effect of pH, temperature and substrate concentration on enzyme action, Paper chromatography/ TLC demonstration for separation of amino acids/ Monosaccharides. Sterilization techniques.Composition of various tissue culture media and preparation of stock solutions for MS nutrient medium. Callus induction from various explants. Micro-propagation, hardening and acclimatization.Demonstration on isolation of DNA. Demonstration of gel electrophoresis techniques and DNA finger printing.

References:

- De Robertis EDP and De Robertis EMF (2006). Cell and Molecular Biology, B I Publications Pvt Ltd, New Delhi.
- Sahney, S.K. and Singh, R.R. (2002). Introductory Practical Biochemistry, Narosa Publishing House, New Delhi.
- Yadav, V.K. and Yadav N. (2007). Biochemistry and Biotechnology-A Laboratory Manual, Pointer Publishers, Jaipur.
- Gupta, P.K. 2006. Biotechnology and Genomics, Rastogi Publication, Meerut.
- Prohit, S.S. 1997, Biotechnology, Agrobotanical Publication Bikaner.
- Rajdan, M.K. 1996, An introduction to, plant tissue culture, Oxford and IBH Publishing Company, New Delhi.
- Ramawat, K.G. 2000, Plant Biotechnology, Kalyani Publishers, Ludhiana.
- Mascarenhas, A.F. 1991. Handbook of Plant Tissue Culture, Publications and Information Division,ICAR, New Delhi.

Elementary Statistics	**Credit hours: 2(1+1)**

Theory:

Introduction to Statistics and its Applications in Agriculture, Graphical Representation of Data, Measures of Central Tendency & Dispersion, Definition of Probability, Addition and Multiplication Theorem (without proof). Simple Problems Based on Probability. Binomial & Poisson Distributions, Definition of Correlation, Scatter Diagram.Karl Pearson's Coefficient of Correlation.Linear Regression Equations. Introduction to Test of Significance, One sample & two sample test t for Means, Chi-Square Test of Independence of Attributes in 2□□2 Contingency Table. Introduction to Analysis of Variance, Analysis of One Way Classification. Introduction to Sampling Methods, Sampling versus Complete Enumeration, Simple Random Sampling with and without replacement, Use of Random Number Tables for selection of Simple Random Sample.

Practical:

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

References;

- Chandel, S.R.S. 1998. Handbook of Agril. Statistics. AchalPrakashanMandir, Kanpur.
- Gupta S.P. 2002. Statistical Methods. Sultan Chand & Sons, New Delhi.
- Agarwal B.L. 1991. Basic Statistics Wiley Eastern, New Delhi.

Elemantary English Credit hours: 2(1+1)

Theory :

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

Practical:

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

References:

- Thomson and Martinet (1995) "A Practical English Grammar" OUP Publication.
- Thomson and Martinet (1997) "A Practical English Grammar, Exercise Books Vol. I & II" OUP Publication.
- Michal Swan (1995) "A Practical English Grammar" OUP Publication.
- David Green (1990) "Contemporary English Grammar Structure Composition" McMillan.
- A.S. Hornby (1997) "Advance Learner's Dictionary" OUP Publication.
- S. Allen (1997) "Living English Structure" Orient Longman.

Fundamentals of Agronomy	**Credit hours: 3(2+1)**

Theory :

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

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

Practical:

Identification of crops, seeds, fertilizers, pesticides and tillage implements, Effect of sowing depth on germination and seedling vigour, Identification of weeds in crops, Methods of herbicide and fertilizer application, Study of yield contributing characters and yield estimation, Seed germination and viability test, Numerical exercises on fertilizer requirement, plant population, herbicides and water requirement, Use of tillage implements-reversible plough, one way plough, harrow, leveler, seed drill, Study of soil moisture measuring devices, Measurement of field capacity, bulk density and infiltration rate, Measurement of irrigation water.

References:

- De, Gopal Chandra (1989). Fundamentals of Agronomy. Oxford & IBH Publishing Co., New-Delhi.
- ICAR (1989). Handbook of Agriculture, Indian Council of Agricultural Research, New-Delhi.
- Michael, A.M. and Ojha, T.P. 1986. Principles of Agricultural Engineering, Vol.II Jain Brothers, New Delhi.
- Morachan, Y.B. (1986). Crop production and management, Oxford & IBH Publishing Co., New-Delhi.

- Porwal, B.L. and Sharma, D.D. (1991). SashyaVigyanKeAdhunicSiddhant (Hindi) Alka Publishers, Ajmer.
- Darashikoh – Nuskha Dar Fanni – Falahat (The Art of Agriculture). Translated from Persian to EnglishbyRazia Akbar (2000) with commentaries by K.L. Mehra, K.L. Chadhan, J.S. Kanwar and Y.L. Nene. Asian Agri- History Foundation, Secunderabad, Bull No. 3, pp : 136.
- Kashyapa – KashuliyaKrishisukti (A Treatise on Agriculture by Kashyapa). Translated from Sanskrit to English by S.M. Ayachit (2002) with commentaries by NaliniSadhale and Y.L. Nene, Asian Agri-History Foundation, Secunderabad, Bull No. 4. pp : 168.
- NCA (1976), Reports of the National Commission on Agriculture, Govt. of India, New Delhi. Ojha,Madhusudan (1942), Kadambini (Sanskrit), Pub. PradyumnaSarmaOjha, Jaipur.
- Parashara – KrishiParashara (Agriculture by Parashara). Translated from Sanskrit to English by Nalini
- Sadhale (1999) with commentaries by H.V. Balkundi and Y.L. Nene. Asian Agri-HistoryFoundation, Secunderabad, Bull No. 2, pp : 104.
- Rapala – Vrikshayurveda (The Science of Plant life). Translated from Sanskrit to English by Nalini
- Sadhale (1996) with commentaries by K.L. Mehra, S.M. Virmani and Y.L. Nene. AsianAgri-History Foundation, Secunderabad, Bull No. 1, pp : 104.
- Nene, Y.L. and Choudhary, S.L. (2002). Agricultural Heritage in India. Asian Agri-History Foundation(AAHF), Secunderabad, Rajasthan Chapter of AAHF, Udaipur.
- Nene, Y.L. 2007. Glimpses of the Agricultural Heritage of India. Asian Agri-Histroy Foundation,Secunderabad, Andhra Pradesh.
- Choudhary, S.L., Sharma, G.S. and Nene, Y.L. (2000). Ancient and Medieval History of IndianAgriculture. Rajasthan College of Agriculture, Udaipur, Rajasthan

Farm Machinery and Power	**Credit hours: 3(2+1)**

Theory:

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

Practicals:

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

Suggested Readings:

- Principles of Agricultural Engineering. Vol. I. (1987). Michael, A.M. and T.P. Ojha. Jain Brothers, Jodhpur.
- Farm Tractors, Maintenance and Repair. (1989). Rai and Jain. Tata McGraw Hill Publ. New Delhi.
- Elements of Farm Machinery. (1989). Srivastava, A.C. Oxford IBH Publ. Company, New Delhi.
- Elements of Agricultural Engineering, Vol. I & III. (1989). Singhal, O.P. SurajPrakashan, Allahabad.