AGRON-211 Crop Production Technology-I (*Kharif* Crops) Credit hours 3(2+1)

Theory

Origin, geographical distribution, economic importance, soil and climatic requirements, varieties, cultural practices, plant protection measures and yield of *kharif* crops. Cereals – rice, maize, sorghum, pearl millet and finger millet, pulses- pigeonpea, mungbean, urdbean and mothbean; oilseeds- groundnut, sesame and soybean; fibre crops- cotton , sunhemp; forage crops- sorghum, cowpea, cluster bean and napier.

Practical

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

Suggested Readings

1. Singh, Chhidda, Singh, Prem and Singh, Rajbir. 2003. Modern Techniques of Raising Field Crops, Oxford & IBH Publishing Co., New Delhi.
2. Panda, S.C.2012. Modern Concepts and Advance Principles in Crop Production. Agrobios (India), Jodhpur
3. Singh, S.S.and Singh, Rajesh. 2013. Crop Management Under Irrigated and Rainfed Conditions. Kalyani Publishers, New Delhi.
4. Singh, S.S.and Singh, Rajesh. 2015. Principles and Practices of Agronomy (5th Re-set), Kalyani Publishers, New Delhi, Kalyani Publishers, Ludhiana.
5. Rathore, P.S. 2000. Techniques and Management of Field Crop Production, Agrobios (India), Jodhpur.
6. Prasad, Rajendra. 2002. Text Book of Field Crops Production, ICAR, New Delhi.
7. ICAR. 2010. Handbook of Agriculture (6th edition), Indian Council of Agricultural Research, New Delhi
8. Reddy, S.R. 2012. Agronomy of Field Crops. Kalyani Publishers, Ludhiana.
9. www.tnau.ac.in Link Student Resources-eagri.tnau.ac.in
10. आर्य, आर.एल एवं आर्य, केशव. 2016. खरीफ सस्य उत्पादन, कल्यानी पब्लिशर्स, लुधियाना
11. शक्तावत, मोहन सिंह एवं व्यास, अभय कुमार. 2000. वैज्ञानिक फसल प्रबन्धन, यश पब्लिशिंग हाउस, बीकानेर

AGRON-212 Rainfed Agriculture and Watershed Management Credit hours 2(1+1)

Theory

Rainfed agriculture: Introduction, types, History of rainfed agriculture & watershed in India; Problems and prospects of rainfed agriculture in India ; Soil and climatic conditions prevalent in rainfed areas; Drought: types, effect of water deficit on physio- morphological characteristics of the plants, Mechanism of crop adaptation under moisture deficit condition; Water harvesting: importance, its techniques, Efficient utilization of water through soil and crop management practices, Management of crops in rainfed areas, Contingent crop planning for aberrant weather conditions. Watershed management: Concept, objective, principles and components, factors affecting watershed management, Land capability classification, Soil and water conservation for arable and non arable lands.

Practical

Studies on climate classification, studies on rainfall pattern in rainfed areas of the country and pattern of onset and withdrawal of monsoons. Studies on cropping pattern of different dry land areas in the country and demarcation of dry land area on map of India. Interpretation of meteorological data and scheduling of supplemental irrigation on the basis of evapo-transpiration demand of crops. effective rainfall and its calculation. Studies on cultural practices viz; mulching, plant density, depth of sowing, seed soaking and seed treatments with chemicals, thinning and leaf removal for mitigating moisture stress. Calculations on moisture deficit and aridity index, Characterization and delineation of model watershed. Field demonstration on construction of water harvesting structures. Acquaintance with different soil conservation structures, identification of grasses and tree species for soil and water conservation. Visit to model watershed area/ dryland research station.

Suggested Readings

1. Jayanthi, C. and Kalpana, R. 2016. Dryland Agriculture, Kalyani Publishers, Ludhiana.
2. Reddy, S.R. and Reddy, G. Prabhakara. 2015. Dryland Agriculture, Kalyani Publishers, Ludhiana.
3. Murthy, J. V. S. 1994. Watershed Management, Wiley Eastern Limited. New Age International Limited, New Delhi.
4. Dhruva Narayan, V.V. Singh, P.P., Bhardwaj, S.P., U. Sharma, Sikha, A.K., Vital, K.P.R. and Das, S.K. 1987. Watershed Management for Drought Mitigation, ICAR, New Delhi.
5. Singh, R.P., Sharma, S., Padmnabhan, N.V. , Das, S.K. and Mishra, P.K. 1990.A Field Manual on Watershed Management, ICAR (CRIDA), Hyderabad.
6. Singh, P.K. 2000. Watershed Management (Design & Practices), e-media Publication, Udaipur, India.

AGECON- 211 Agricultural Finance and Co-Operation Credit hours: 3(2+1)

Theory

Agricultural Finance- meaning, scope and significance, credit needs and its role in Indian agriculture. Agricultural credit: meaning, definition, need, classification. Credit analysis: 7 P's, 4 R's, and 3C's of credits. Sources of agricultural finance: institutional and non-institutional sources, commercial banks, social control and nationalization of commercial banks, Micro financing including KCC. Lead bank scheme, RRBs, Scale of finance and unit cost. An introduction to higher financing institutions – RBI, NABARD, ADB, IMF, world bank, Insurance and Credit Guarantee Corporation of India. Cost of credit. Recent development in agricultural credit. Preparation and analysis of financial statements – Balance Sheet and Income Statement. Basic guidelines for preparation of project reports. Concept of risk and uncertainty occurs in agriculture production, nature and sources of risks and its management strategies**,** Crop/livestock/machinery insurance – weather based crop insurance, features, determinants of compensation.

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

Practical

Analysis of progress and performance of cooperatives using published data. Analysis of progress and performance of commercial banks and RRBs using published data. Visit to a commercial bank, cooperative bank and cooperative society to acquire firsthand knowledge of their management, schemes and procedures. Estimation of credit requirement of farm business – A case study. Preparation and analysis of balance sheet – A case study. Preparation and analysis of income statement – A case study. Appraisal of a loan proposal – A case study. Techno-economic parameters for preparation of projects. Preparation of Bankable projects for various agricultural products and its value added products. Different types of repayment plans.

Suggested readings:

1. I. Bhavani Devi,P. Raghu Ram,S. Subba Reddy,T.V. Neelakanta Sastry, 2009, Agricultural economics, Oxford and IBH Co. Pvt. Ltd., New Delhi.
2. Kamat, G.S., 1978, New Dimensions of Cooperative Management, Himalyan Publishing House, Mumbai.
3. Nelson and Murray, 1988. Agricultural Finance. Kalyani Publishers, New Delhi.
4. Pandey, U.K. 1990. An Introduction to Agricultural Finance, Kalyani Publishers, New Delhi.
5. Singh, J.P., 1988, Agricultural Finance Theory and Practices, Ashish Publishing House, New Delhi.
6. Muniraj, R. 1987, Farm finance for development, Oxford & IBH Pub. Co., New Delhi.

ENTO. 211 FUNDAMENTALS OF ENTOMOLOGY CREDIT HOURS 3 (2+1)

Theory:

Part – I

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

Part-II

Insect Ecology: Introduction, Environment and its components. Effect of abiotic factors– temperature, moisture, humidity, rainfall, light, atmospheric pressure and air currents. Effect of biotic factors – food competition, natural and environmental resistance.

Part – III

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

Practical:

Methods of collection and preservation of insects including immature stages; External features of Grasshopper/Blister beetle; Types of insect antennae, mouthparts and legs; Wing venation, types of wings and wing coupling apparatus. Types of insect larvae and pupae; Dissection of digestive system in insects (Grasshopper); Dissection of male and female reproductive systems in insects (Grasshopper); Study of characters of orders Orthoptera, Dictyoptera, Odonata, Isoptera, Thysanoptera, Hemiptera, Lepidoptera, Neuroptera, Coleoptera, Hymenoptera, Diptera and their families of agricultural importance. Sampling techniques for estimation of insect population and damage.

Suggested Readings:

1. Chapman RF. 1998. The Insects: Structure and Function. Cambridge Univ. Press, Cambridge.
2. Nayar, K.K., Ananthakrishnan, T.N. and David. B.V. 1976. General and Applied Entomology. McGraw Hill Publishing Co. Ltd., New Delhi.
3. Richards, O.W. and Davies, R.G. 1977. Imm's General Text Book kof Entomology, Vol. I & II. Chapman and Hall, London.
4. Pant N.C. and Ghai, S., 1981. Insect Physiology and Anatomy, ICAR.
5. Romoser, W.S. and Staffolano, W.S. Jr. 1994. The Science of Entomology. III Edition, Winn C. Brown Publishers.
6. Gullan, P.J. and Cranston, P.S. 2005. Insects: an outline of entomology, III edition Chapman & Hall Publication.
7. Duntson PA. 2004. The Insects: Structure, Function and Biodiversity. Kalyani Publ., New Delhi.
8. Evans JW. 2004. Outlines of Agricultural Entomology. Asiatic Publ., New Delhi.
9. Gillott, C. 1995. Entomology, 2nd Ed. Plenum Press, New York, London.
10. Triplehorn CA & Johnson NF. 1998. *Borror and DeLong's Introduction to the Study of Insects.* 7th Ed. Thomson/ Brooks/ Cole, USA/Australia.
11. Southwood TRE & Henderson PA. 2000. *Ecological Methods.* 3rd Ed. Methuen & Co. Ltd., London.
12. Price PW. 1997. *Insect Ecology*. 3rd Ed. John Wiley, New York.

AGENGG-211 Farm Machinery and Power Credit hours 2(1+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. Familiarization with different systems of I.C. engines: Air cleaning, cooling, lubrication & fuel supply. Farm tractor and their types, Familiarization with tractor systems: clutch, gear box, differential, final drive, and hydraulic. Cost analysis of tractor power and attached implement. Familiarization with Primary and Secondary Tillage implement: Mould board plough and disc plough, implement for intercultural operations: disc harrow. Some Implement for hill agriculture. Familiarization with sowing and planting equipment, calibration of a seed drill and solved examples. Familiarization with Plant Protection equipment: knapsack sprayer and duster, Familiarization with harvesting and threshing equipment.

Practical

Different components of an I.C. engine, 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, familiarization with brake, steering, hydraulic control, tractor driving, familiarization with operation of power tiller, familiarization with mould plough, disc plough, disc harrow, seed-cum-fertilizer drills, planters and calibration, familiarization with different types of sprayers and dusters, familiarization with harvesting and threshing machinery, familiarization with implements for hill agriculture.

Suggested Readings

1. Michael, A.M. and Ojha, T.P. 1993, Principals of Agricultural Engineering, Jain Brothers, New Delhi.
2. Sahay, Jagdishwar. 1992. Elements of Agricultural Engineering, Agro Book Agency, Patna.
3. Nakra, C.P. 1970. Farm Machinery & Equipment, Dhanapat Rai and Sons, New Delhi.

FSN-211 Principles of Food Science and Nutrition Credit hours: 2(2+0)

Theory

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

Suggested Readings

1. Manay, S.and Shadaksharaswamy, M. 2001. Foods: Facts and Principles, II Edition. Published by New Age International P (Ltd.) Publishers. Reprint 2003.
2. Sharma, A. 2010. Text book of Food Science &Technology, 2nd Revised and Enlarged Edition. Ibdc Publishers.
3. Swaminathan, M. 1998.Advanced Text-Bok on Food &Nutrition, Vol.I, Revissed and Enlarged Edition Published by The Bangalore Printing And Publishing Co.Ltd.
4. Robert L.Shewfelt. 2013. Introducing Food Science.CRC press.

AGI 211 AGRICULTURAL INFORMATICS Cr Hrs. 2(1+1)

Theory

Introduction to Computers, Anatomy of Computers, Memory Concepts, Units of Memory, Operating System, types of operating system, Applications of MS-Office for creating, Editing and Formatting a document, Data presentation, tabulation and graph creation, statistical analysis, mathematical expressions, Database, concepts and types, creating database, uses of DBMS in Agriculture, Internet and World Wide Web (WWW), Concepts, components and creation of HTML, XML coding.

Computer Programming, General Concepts, Introduction to programming languages concepts and standard input/output operations, variable and constantans, operators and expressions, Flow of control, Inbuilt and User defined functions, programming techniques for agriculture.

e-Agriculture, concepts, design and development. Application of innovative ways to use information and communication technologies (IT) in Agriculture. ICT for data collection, IT application for computation of water and nutrient requirement of crops etc., Computer controlled devices (automated systems) for Agri-input management, Smartphone mobile apps in Agriculture for farm advises, market price, post-harvest management tec., Introduction to DSS and its role in agriculture, Introduction and role of expert system in agriculture.

Practical

Study of Computer Components, accessories. Introduction to different operating systems such as WINDOW,UNIX, LYNUX, creating, files and folders, File management. Use of MS-WORD and MS Power Point for creating, editing and presenting a scientific Document, Handling of Tabular data, animation, video tools, art tool, graphics, template and designs. MS-Excel-creating a spreadsheet, use of statistical tools, writing expressions, creating graphs, analysis of scientific data, handling macros. MS-ACCESS: Creating Database, preparing queries and reports, demonstration of Agri-Information system.

Introduction to World Wide Web (WWW) and its components. Introduction to HTML, Use of smart phones and other devices in agro-advisory and dissemination of market information.

Suggested Reading:

1. Internet: The Complete Reference 2 Sub Edition by Margaret Levine Young.
2. Office 2013 All-In-One For Dummies by Peter Weverka.
3. Computer Fundamentals (With CD) 6th Edition 6th Edition by Pradeep Sinha and Priti Sinha.
4. Principles of Programming Languages by Er. Anil Panghal.
5. E-Agriculture and Rural Development by Charalampos Patrikakis, Blessing Maumbe.

PBG-211 Fundamentals of Plant Breeding Credit hours: 3(2+1)

Theory

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. Domestication, Acclimatization, introduction; Centre of origin/diversity, component of Genetic variation; Heritability and genetic advance; Genetic basis and breeding methods in self-pollinated crops-mass and pure line selection, hybridization techniques and handling of segregating population; Multiline concept. Concepts of population genetics and Hardy-Weinberg Law, Genetic basis and methods of breeding cross pollinated crops, modes of selection; Heterosis and inbreeding depression, development of inbred lines and hybrids, composite and synthetic varieties; Breeding methods in asexually propagated crops, clonal selection and hybridization; Wide hybridization and pre-breeding; Polyploidy in relation to plant breeding, mutation breeding-methods and uses; Breeding for important biotic and abiotic stresses; Biotechnological tools-DNA markers and marker assisted selection. Participatory plant breeding; Intellectual Property Rights, Patenting, Plant Breeders and & Farmer's Rights.

Practical

Plant Breeder's kit, Study of germplasm of various crops. Study of floral structure of self-pollinated and cross pollinated crops. Emasculation and hybridization techniques in self & cross pollinated crops. Consequences of inbreeding on genetic structure of resulting populations. Study of male sterility system. Handing of segregation populations. Methods of calculating mean, range, variance, standard deviation, heritability. Designs used in plant breeding experiment, analysis of Randomized Block Design. To work out the mode of pollination in a given crop and extent of natural out crossing. Study of pollen viability and pollen size,Prediction of performance of double cross hybrids.

Suggested Readings:

Allard, R.W. 2000. Principles of Plant Breeding, John Wiley & Sons.New Yourk.

Blumm, A. 1988. Plant Breeding for Stress Environments. CRC Press Inc., USA

Chahel,G.S.and S.S.Gosal.2002.Principles and Procedures of Plant Breeding, Biotechnological and Conventional Approches. Narosa Publishing House, New Delhi.

Chopra, V.L. 2001. Breeding Field Crops. Oxford & IBH Publsihing Co Pvt Ltd, New Delhi

Chopra, V.L. 2004. Plant Breeding. Oxford & IBH Publsihing Co Pvt Ltd, New Delhi

Chopra, V.L. and Shyam Prakash. 2002. Evolution and adaptation of cereal crops. Oxford and IBH Publsihing Co Pvt Ltd, New Delhi

Poehlman, J.M. and Borthakur, D.N. 1972. Breeding Asian Field Crops. Oxford & IBH.

Roy, Darbeshwar. 2003. Plant Breeding, Analysis and Exploitation of Variation. Narosa Publ. House.

R.K.Ramchandra,2015.Princilpes of Plant Breeding, Jaya Publishing House,Delhi

Sharma, J.R. 2001. Principles and Practice of Plant Breeding. Tata McGraw-Hill.

Simmonds, N.W. 1990. Principles of Crop Improvement. English Language Book Society.

Singh, B.D. 2006. Plant Breeding. Kalyani. Publishers,New Delhi

Snustad, D. P. and Simmons M.J. 2006. Genetics, 4th Ed. John Wiley & Sons.

HORT 211 Production Technology for Vegetable and Spices Credit hours: 2(1+1)

Theory

Importance of vegetables & spices in human nutrition and national economy, brief about origin, area, production, improved varieties and cultivation practices such as time of sowing, sowing, transplanting techniques, planting distance, fertilizer requirements, irrigation, weed management, harvesting, storage, physiological disorders, disease and pest control and seed production of important vegetable and spices crop-salanaceous (tomato, brinjal, chilli), cucurbitaceous (bottle gourd, round gourd , bitter gourd, water melon, musk melon, pumpkin, ridge gourd, sponge gourd), cole crops (cabbage, cauliflower, broccolli), Bulb crops (Onion, garlic), tuber crops (sweet potato, greater yam, colocasia), leafy vegetables (amaranthus, spinach,), root crops (turnip, raddish, carrot), other vegetables (peas, okra, cowpea, cluster bean and pointed gourd), spices- cumin, coriander, fennel, fenugreek, ginger, turmeric, black pepper, cardamom.

Practical

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

Suggested Readings:

1. Chadha, K.L. & Kaloo, G. Advances in Horticulture. Vol.5&6. Vegetable Crops; Malhotra Publishing House, New Delhi.
2. Chaudhary, B. 1996. Vegetables, NBT, New Delhi
3. Bose, T.K., Kabir, J., Maity. T.K., Parthasarthy, V.A. and Sons, M.G. 2006 Vegetable Crops, Vol.I,II&III (IIIrd revised edition).
4. Singh, S.P. 1989. Production Technology of Vegetable Crops, Agril. Research Communication Centre, Karnal.
5. Chadha, K.L.. 2010. Handbook of Horticulture (New eds). Indian Council o Agricultural Research, New Delhi
6. Purthi. J.S. 2001. Major Spices. Indian Council of Agriculture Research, Nev Delhi
7. Sen, N.L., Dashora, L.K. and Dashora, A. 2003. Ropen Phaslein, Masalein Sughandit avem Aushadhyia Poudhay. Alka Publication. Ajmer (Raj.)