Final year Detail Curriculum

The Outline of the Degree Programme

Semester	Name of the Semester	Series	Courses Offered	Credits
1	First Year First Semester	11000	Core Courses	13
2	First Year Second Semester	12000	Core Courses	18
3	Second Year First Semester	21000	Core Courses	19
4	Second Year Second Semester	22000	Core Courses	20
5	Third Year First Semester	31000	Core Courses	21
6	Third Year Second Semester	32000	Core Courses	14
			Specialization Courses	04
7	Fourth Year First Semester	41000	Core Courses	05
			Specialization Courses	08
8	Fourth Year Second Semester	42000	Research Project	08
	Total			**130**

Fourth Year First Semester – Core Courses (41000):

	Code	Title	Credits
1.	AGRS 41012	Experimental Design	2:30/00
2.	AGRS 41022	Computer Application in Biostatistics	2:15/30
3.	CCC 41011	Experiential Learning	1:00/60
4.	ACC 41011	Scientific Writing	1:15/00
		Total	***5***

Fourth Year First Semester – Specialization Courses (41000):

Department of Agronomy

No.	Code	Title	Credits
1.	AGRS 41012	Experimental Design	2:30/00
2.	AGRS 41022	Computer Application for Biostatistics	2:15/30
3.	AGRS 41032	Rice Production Technology	2:23/15

4.	AGRS 41042	Commercial Orchard Crop Production	2:23/15
5.	AGRS 41052	Commercial Nursery Management	2:23/15
6.	AGRS 41062	Seed Production Technology	2:23/15
7.	AGRS 41072	Floriculture and Landscaping	2:23/15

Department of Animal Science

	Code	Title	Credits
1.	ANS 41012	Dairy Production and Technology	2: 23/15
2.	ANS 41022	Meat Production and Technology	2: 23/15
3.	ANS 41032	Reproductive Physiology	2: 23/15
4.	ANS 41042	Animal By-product Technology	2: 23/15
5.	ANS 41052	Wild life of Economic Importance	2: 23/15
6.	ANS 41062	Animal Biotechnology	2: 30/00
7.	ANS 41072	Lactation Physiology	2:30/00
8.	ANS 41082	Ruminant Nutrition	2:23/15
9.	ANS 41092	Monogastric Nutrition	2:23/15
10.	ANS 41102	Integrated Animal Production Systems	2:23/15

Department of Agricultural Biology

No.	Code	Title	Credits
1.	AGBS 41012	Integrated Pest Management	2:30/00
2.	AGBS 41022	Soil Borne Pathogens	2:23/15
3.	AGBS 41032	Biological Control of Pests	2:23/15
4.	AGBS 41042	Vermitechnology and Biowaste Management	2:23/15
5.	AGBS 41052	Invertebrate Pathology	2:23/15
6.	AGBS 41062	Microbial Inoculants in Agriculture	2:23/15
7.	AGBS 41072	Plant Tissue Culture	2:30/00
8.	AGBS 41082	Vertebrate Pest Management	2:23/15

9.	AGBS 41092	Apiculture	2:23/15
10.	AGBS 41102	Mushroom Cultivation	2:23/15
11.	AGBS 41112	Genetic Engineering	2:30/00
12.	AGBS 41122	Transgenics in Crop Improvement	2:30/00
13.	AGBS 41132	Plant Biotechnology	2:30/00

Department of Agricultural Chemistry

No.	Code	Title	Credits
Soil Science			
1.	ACHS 41012	Land Evaluation and GIS Applications	(2: 15/30)
2.	ACHS 41022	Soil and Plant Analytical Techniques	(2: 23/15)
3.	ACHS 41032	Land degradation Management and GIS Applications	(2: 15/30)
4.	ACHS 41042	Land Resources and Environmental issues	(2: 30/00)
5.	ACHS/AGBS 41012	Soil Biology and Fertility	(2: 23/15)
Food Science			
6.	ACHS 41052	Food Preservation Technology	(2:30/00)
7.	ACHS 41062	Food Analysis	(2:20/20)
8.	ACHS 41072	Food Processing	(2:23/15)
9.	ACHS 41082	Food and Nutrition	(2: 30/00)
10.	ACHS 41109	Food Product Development	(2: 00/60)

Department of Agricultural Engineering

	Code	Title	Credits
1.	AENS 41012	Energy, Environment and Waste Management	2:23/15
2.	AENS 41022	Food Processing Engineering	2:23/15
3.	AENS 41032	Hydrological Modeling of Rainfall and Runoff	2:30/00

4.	AENS 41042	Machinery and Structural Design	2:15/30
5.	AENS 41052	Engineering Mechanics	2:30/00
6.	AENS 41062	Electrical Power & Machines	2:30/00
6.	AENS 41072	Cleaner Production Technology	2:30/00

Department of Agricultural Economics

	Code	Title	Credits
1.	AECS 41022	International Trade and Monetary Economics	2:30/00
2.	AECS 41032	Introduction to Management Science and Linear Programming	2:30/00
3.	AECS 41052	Rural Economics and Farm Household Models	2:30/00
4.	AECS 41062	Marine Resource Economics and Bio Economic Modeling	2:30/00
5.	AECS 41072	Econometrics	2:30/00
6.	AECS 41082	Project Analysis	2:30/00

Total	***8***

Fourth Year Second Semester (42000)

	Code	Title	Credits
1.	CCC 42016	Research Project	8

Course Contents for Forth Year First Semester

AGRS 41012 EXPERIMENTAL DESIGN (2:30/00)

Objectives

Students will furnish with knowledge and skill on designing of single factorial and multi-factorial experiments, data analysis, interpretation and dawning meaningful conclusion from statistical analysis.

Learning Outcomes

- Translate research objectives into hypotheses
- Choose the appropriate design, build the model, check validity of the model and assumption and perform the analysis
- Analyze the research data using appropriate statistical techniques
- Draw meaningful conclusion from the data analysis and interpret the data in non-statistical terms.

Course contents

Theory

Principles of experimental designs, Estimate of experimental error, complete randomized design, randomized complete block design, Latin square design and modifications, Mean separation and commonly used mean separation procedures, Interaction and factorial experiments, analysis of factorial experiments, two-factor and higher order, modifications to factorial experiments; split-plot design, nested factor design, analysis of covariance.

Recommended Readings

1) Barrentine, L .B. (1999) An Introduction to design of experiments: A simplified approach. ASQ quality press, Wisconsin.

2) Hoshmand, A. R . (1994) Experimental Research Design and Analysis: A Practical Approach for Agricultural and Natural Sciences. CRC Press.

3) Quinn, G. P. and Keough, M. J. (2002) Experimental Design and Data Analysis for Biologists. Cambridge University Press.

AGR41022 COMPUTER APPLICATIONS IN BIO STATISTICS (2:15/30)

Objectives

Furnish the students with practical skill on use of different statistical packages to analyse data from experiments and surveys and drawing valid inferences using various statistical techniques available in statistical software packages and interpret statistical results in a professional manner.

Learning Outcomes

- Able to select the appropriate test based on the data types
- Show the ability to apply regression, multivariate and time series techniques to do data analysis
- Distinguish Parametric and nonparametric test procedures
- Handle different statistical packages and draw conclusion and inference results using computer aided analysis
- Draw meaningful conclusion from the data analysis and interpret the data in non-statistical terms
- Use MINITAB and SAS to carry-out more complex type of statistical analysis
- Present the result of their experiments with meaning conclusion with the aid of different statistical packages

Course Content

Practical

Analysing the results from different experimental designs using statistical packages; Analysing of Multivariate data; Analysing time series data, analysis, nonparametric analysis, categorical

data analysis using different statistical packages and interpretation of the data, presentation of experimental results using computer packages.

Recommended Readings

1) Everitt, B. S. and Der, G. (1997) A Handbook of Statistical Analysis's Using SAS. Chapman & Hall.
2) Johnson, R. (1996) Elementary Statistics. 7th edition. Duxbury Press.
3) Middletion, (1995) Data Analysis Using Microsoft Excel 5.0. Duxbury press.
4) Pasewark, (2002) Course Technology, Microsoft Office XP Introductory. Thomson learning.

CCC 41011 EXPERIENTIAL LEARNING (1: 00/60)

Objectives

The is a field based inter-disciplinary practical course designed to strengthen student's experience in farming through interaction with farmers.

Learning Outcomes

On completion of the course the students will be able to

- Manage a farm in an integrated manner
- Analyze and propose solutions for the field based problems
- Communicate effectively with farmers and society
- Work as a team with leadership, risk bearing, analytical and presentation skills

Course Contents

Each student is assigned to a host farmer to familiarize and acquire skills on farm operations and farming conditions. The student has to visit the farmer field one day in a week and interact with the host farmer. The student has to analyze the farming condition by applying the knowledge

gathered in the first three years with the assistance of staff members. At the end students have to submit their findings through presentation and a report.

ACC 41011 SCIENTIFIC WRITING (1:08/15)

Objectives

To educate the students on problem identification, plan and implementation of research methodology, analyze the information gathered, report writing, writing scientific papers, preparing posters and oral presentation.

Learning Outcomes

- Identify research problems appropriately
- Carry out a research with correct methodology
- Choose appropriate analytical tools
- Write scientific reports
- Write and present scientific papers

Course contents

Theory

Introduction to research, literature research, proposal writing, experimental designs, data analysis, report writing, research ethics, writing and presenting scientific papers.

Practical

Literature search, use of language in report writing, data analysis, oral and poster presentation.

Recommended Readings

1. Malmfors, B., Garnworthy, P. and Grossman,M. (2000) Writing and presenting scientific papers. Nottinggham University press, Uinted Kingdom.

2. Day, R.A. (1998) How to write and publish a scientific paper. 5th Edition. Amazon.com.
3. Davis, M. (1997) scientific papers and presentations. 2nd Edition. Amazon.com.

Department of Agronomy

AGRS 41032 RICE PRODUCTION TECHNOLOGY (2:23/15)

Objectives

To furnish the students with knowledge and practical skills on different rice farming systems in Sri Lanka and teach appropriate management practices to increase rice crop yield, and use appropriate post harvest technology to reduce losses and improve economic value of rice.

Learning Outcomes

- Critically analyse the constrain faced by rice farmers
- Recommend suitable variety for rain fed and irrigated rice fields with appropriate technology to maximise the profit
- Apply acquired practical skills on land preparation, pre-treatment of seeds, crop establishment, fertilizer, irrigation, weed, pest and disease management
- Recommend proper methods to improve the crop productivity yield and minimise the post harvest losses

Course content

Theory

Rice production systems in Sri Lanka, growth and development of rice varietal development, improved plant types and its contribution to yield, crop establishment, nutrient management, integrated weed control, crop water requirement and management strategies to increase the crop yield, harvesting, Post harvest technology and value addition of rice products, cost benefit analysis of rice production

Practical

Identification of different rice varieties; Pre-treatment of rice for sowing; Land preparation and crop establishment; Applying of pre-emergence and post emergence herbicides, fertilizer assess their performance; Identification of important pest and disease and management; Estimation of yield components and yield.

Recommended Readings

1) Anjaneyula, A., Satapathy, M.K. and Shukla, V.D. (1994) Rice tungro. Oxford and IBM publication, New Delhi.

2) Grist, D.H. (1965) Rice. 4th edition. London, Longmans.

AGRS 41042 COMMERCIAL ORCHARD CROP PRODUCTION (2:23/15)

Objectives

To impart students knowledge and practical skill about the present status of fruit production in various ecological regions of Sri Lanka , requirements for commercial orchards, and suitable management agronomic practices to maintain profitable commercial orchards.

Learning Outcomes

- Identify the suitable orchard crops that could be grown in a commercial scale in different ecological regions
- Plan and advice on various aspects in establishing large scale orchards
- Recommend different agronomic practices required to get uniform quality products
- Apply the acquired practical knowledge and skills to inproduction of quality planting materials

Course Contents

Theory

Classification of fruits, present status of orchard production in Sri Lanka, environment and its effect on orchard crop production, potential orchard crops for commercial cultivation in LCDZ, propagation techniques, stock scion relationship and incompatibility, training and pruning of orchard crops, fruit physiology and post harvest technology

Practical

Identification of important cultivar of fruit crops grown in Sri Lanka; Establishment of seedling vegetative nursery; Production of grafted and budded plants; Pruning and training of fruit crops; Visit to commercial orchards.

Recommended Readings

1) Bal, J.S. (1999) Fruit growing. Kalyani publication, Ludhiana.

2) Chabot, E. (1955) The new green house gardening for everyone. Mbarrows, New York .

3) Chattopadhyay, T.K. (1997) A text book on pomology; subtropical fruits. Kalyani publication, Ludhiana.

4) FAO, (1961) Agricultural and horticultural: their production, control and distribution. Food and Agricultural Organization, United nation, Rome.

5) Singh, S.P. (1998) Commercial fruits. kalyani publication, Ludhiana.

AGRS 41052 COMMERCIAL NURSERY MANAGEMENT (2:23/15)

Objectives

To impart knowledge and practical skill on planning and establishing commercial nurseries of vegetables, orchard crops, cut flower and foliage plants and management of mother plants for quality planting materials.

Learning Outcomes

- Apply the acquired practical knowledge and skill on propagation and establishment of commercial nurseries of vegetables, fruits, cut flower, foliage plants and coconut for marketing.

- Draw plan for commercial plant nurseries of horticultural crops.

Course Contents

Theory

Vegetative propagation and propagators for the establishment of commercial nurseries of orchard and floriculture crops, commercial seedling production for vegetable and other field crops, conservation of traditional varieties, establishment of mother plants, special agronomic practices for profitable nursery management, propagation and continuous supply of nursery plants and cost benefit analysis.

Practical

Nursery preparation and maintenance for vegetable crops; nursery establishment of horticultural crops; vegetative propagation and potting of important fruit crops; propagation and potting of cut flower and foliage plants; Visits to commercial nurseries.

Recommended Readings

1) Amaranath,V. (2007) Nursery and landscaping. agrobios, Jodhpur, India**.**

2) Gill, S.S., Bal, J.S. and Sandhu, A.S. (1998) Raising of fruit nursery. kalyani publication, Ludhiana

AGRS 41062 SEED PRODUCTION TECHNOLOGY (2:23/15)

Objectives

To impart knowledge and practical skill on presence status of seed industry in Sri Lanka, agronomic appropriate techniques to produce quality seeds for export and importance of packing and storage in seed quality and governmental policies in seed importation.

Learning Outcomes

- Describe the present situation of seed industry in Sri Lanka
- Explain government and private sector involvement in production and marketing of seeds
- Quality seed production programme and seed certification
- Apply the gained knowledge and skills on seed testing
- Propose proper storage facilities for different types of seeds.

Course Contents

Theory

Seed production program for rice and other field crops in Sri Lanka, Global seed industry, crop breeding and varietal development programmes, quality seed and the factors affect the seed quality, seed testing, seed certification, seed policies in Sri Lanka, seed storage and marketing, cost benefit analysis of various seed production.

Practical

Seed testing and certification of different seed and planting materials; Assessing the suitability of different packaging materials, storage conditions, transport facilities for quality seeds; Visit to different commercial seed farms.

Recommended Readings

1) Agrawal, P.K. (1995) Techniques in seed science and technology.

2) Benech, R. and Rodolfo, A. (2004) Handbook of Seed Physiology: Applications to Agriculture. CRC Press.

3) David R.Murray. (1984) Seed physiology. Academic press, Sydney.

4) Mondal, S.S. (2009) Seed Production of field crops. New India Publishing Agency.

AGRS 41072 LANDSCAPING AND FLORICULTURE (2:23/15)

Objectives

To impart knowledge and practical skill on present situation of floriculture trade in Sri Lanka, propagation and establishment of cut flower and foliage plants, architecture and design for landscaping and selection of plants for landscaping, green landscaping etc.

Learning Outcomes

- Apply the gained practical knowledge and skills on propagation techniques and establishment of cut flowers and foliage plants
- Use the knowledge and skills for interior decoration
- Able to plan and design different landscaping model

Course Contents

Theory

World trade of floriculture, floriculture development in Sri Lanka, cut flowers and pot planting industry, agronomic practice adopted to produce quality cut flowers from anthurium, orchids, roses, carnations, chrysanthemum, special agronomic practices to increase productivity, foliage plants for interior decoration, introduction for landscape, essential techniques in planning of commercial landscaping, architecture and design of landscaping, green landscaping.

Practical

Propagation techniques of cut flower and foliage plants; Collection of plants for landscaping; Green landscaping models; Common models of landscaping; Flower arrangements; Visit to commercial landscaping industries

Recommended Readings

1) Desh raj. (2001) Floriculture and Landscaping: Guide to UGC national eligibility test ICAR, JRF, SRF, NET, ARS. Kalyani Publication, Ludhiana.

2) Griner Charles. (2011) Floriculture: Designing and merchandising. 3rd edition. Cengage learning, Delmar.

Department of Animal Science

ANSS41012 DAIRY PRODUCTION AND TECHNOLOGY (2: 23/15)

Objectives

Understand the mammary gland development. Use the properties of milk to make different dairy products. Understand the process of quality control in milk and dairy processing.

Learning Outcomes

- Determine the chemical composition of milk and factors that affect its composition
- Acquainted the importance of milk and dairy products in human nutrition
- Knew the anatomy and development of mammary gland
- Solve the problems that arise during production by evaluating the working conditions in the plant
- Provide the required for productive and economical production

Course Contents

Theory

Overview of mammary gland development, properties of milk, milk constituents and spoilage of milk, milk borne diseases, mechanism of milk coagulation, milk processing and quality control, problems associated with milk processing.

Practical

Field visit to milk processing plants, visit to milk collecting centres, quality test for milk and milk products, fat determination of milk, cream, butter and cheese, determination of microorganisms in milk and milk products, improving consumer preference of existing dairy products.

Recommended Readings

1. Gianacliscaldwell. (2010) The farmstead creamery advisor: the complete guide to building and running a small, farm-based cheese business; 1st Edition. Chelsea green publishing.
2. Britz, T. and Robinson, R.K. (2008) Advanced dairy science and technology. 1st Edition. Wiley-blackwell.
3. Rritz, J.T. and Robinson, K.R. (2008) Advance dairy science and technology. Blackwell publishing.
4. Tamime, A.Y. and Robinson, R.K. (2007) Tamime and robinson's yoghurt science and technology. 3rd Edition. CRC press.
5. Hui,Y.H. (2006) Dairy science and technology hand book: principles and properties. Z Wiley-interscience.
6. Walstra, P., Wouters, J.T.M. and Geurts, T.J. (2006) Dairy science and technology food science and technology. volume 146 of food science and technology - crctaylor&francis.
7. Robinson, R.K. (2002) Dairy microbiology handbook: the microbiology of milk and milk products. 3rd Edition. Wiley-interscience.
8. Varnam, A.H. and Sutherland, J.P. (2001) Milk and milk products: technology, chemistry and microbiology volume 1 of food products series. Springer.
9. Walstra, P. (1999) Dairy technology: principles of milk properties and processes. volume 90 of food science and technology volume 90 of chromatographic science. Marcel dekker.
10. Edgar spreer, axel mixa. (1998) Milk and dairy product technology. Marcel dekker.

ANSS41022 MEAT PRODUCTION AND TECHNOLOGY (2: 23/15)

Objectives

Understand the planning of slaughter house, modern meat preservation techniques, quality control and value addition to meat.

Learning Outcomes

- Able to design a modern slaughter house
- Adopt appropriate techniques while slaughtering animals
- Describe importance of milk in human nutrition
- Able to preserve and value add meat.
- Adopt proper quality control measures.

Course contents

Theory

Slaughter house planning, recent trends in meat marketing, modern meat preservation, growth of meat animals, meat and human nutrition, production of value added products of meat and quality control.

Practical

Preparation of meat products, slaughtering animals, visit to slaughter house and meat processing units, quality control of meat products

Recommended Readings

1. Warriss, P.D. (2010) Meat science: an introductory text (modular texts). 2nd Edition. Cabi.
2. Gregory N.G. (1998) Animal welfare and meat science.
3. Gil. (1990) A colour atlas of meat inspection. 1st Edition. CRC press.
4. Mutkoski., Stephon, A. and Marcial S. (1981) Meat and fish management. Berlinton Pubs Wadsworth Publication.
5. Lawrie R. (edi) (1980) Developments in meat science. Burgress – Intl – Ideas.
6. Joseph, S. (1978) Meat science and processing. Paladin House.
7. Maggie, B. (1976) Meat processing at home. Intl publication service.

ANSS41032 REPRODUCTIVE PHYSIOLOGY (2: 23/15)

Objectives

Understand the process from conception to birth with regard to hormones and physiology and manipulate the knowledge to achieve maximum reproduction efficiency. Understand the effect of environment on male and female reproduction.

Learning Outcome

- Discuss the process from conception to birth pertaining to hormonal control and associated morphological and physiological changes
- Describe the effect of environment on male and female reproduction
- Able to use advances in reproductive technology to manipulate the normal reproduction process to exploit the male and female genetic potential.

Course Contents

Theory

Growth and development process, fertilization, gestation and parturition, hormonal control of gestation and parturition, effect of environment on male and female reproduction, recent advances in reproductive physiology.

Practical

Examining reproductive systems of farm animals, pregnancy diagnosis, oestrus detection, determination of reproductive efficiency, exposure to reproductive techniques, diagnosis of reproductive disorders.

Recommended Readings

1. Gordon, J.R.M., Doak, A. and Herman, H.A. (2003) Artificial insemination & embryo transfer of dairy & beef cattle including information pertaining to goats, sheep, horses, swine and other animals: Involved in genetic development. 9th Edition. Prentice hall.
2. Hafez, E.S.E. and Hafez, B. (2000) Reproduction in farm animals. 7th Edition. Wiley-blackwell.
3. Biochemical Society. (1995) Reproduction in domestic ruminant iii. Journals of reproduction and fertility ltd, Portland Pr.
4. Hafez, E.S.E. (1987) Reproduction in farm animals. Lea and febriger, Philadelphia.

5. Hunter, R.H.F. (1981) Physiology and technology of reproduction in female domestic animals. Acadamic press, 111 fifth avenue, New York 10003, New York.
6. Scaramuzzi, R.J., Lincoln, D.W. and Weir, B.J. (1981) Reproductive endocrinology of domestic ruminants. Journals of reproduction and fertility ltd.

ANSS41042 ANIMAL BY-PRODUCT TECHNOLOGY(2: 23/15)

Objectives

Understand the ways to convert slaughter house wastes into edible products, animal feed and other uses.

Learning Outcomes

- Describe the ways of converting slaughter house wastes into edible products and animal feed
- Utilize the products for other uses like production of hormones, drugs and enzymes
- Use of hide and skin for production purpose

Course Contents

Theory

Edible by-products, upgrading of slaughter house waste for edible use, rendering of by-products and animal feed, other use of by-products, production of hormones, drugs, enzymes, hide and skin.

Practical

Factory visits

Recommended Readings

1. Hui, Y.H. and ÖzgülEvranuz, E. (2012) Handbook of Fermented Food and Beverage Technology, Second Edition: Handbook of Animal-Based Fermented Food and Beverage Technology. 2nd Edition. CRC Press.

2. Kowalski, M. (2009) New Products.(Grabbit Tool Company introduces traps)(Bobcat Company introduces heat gloves)(B.R.T. Technologies introduces engines): An article from: Farm Journal. Farm Journal Media
3. Simmonds, P.L. (2009) Animal Products: Their Preparation, Commercial Uses, and Value [1877]. Cornell University Library.
4. Ockerman, H.W and Conly L. Hansen. (1999) Animal By-Product Processing & Utilization. 1st Edition. CRC Press.
5. Kumar, M. (1990) Handbook of Rural Technology for the Processing of Animal By-Products (FAO Agricultural Services Bulletin). Stationary Office Books

ANSS41052 WILD LIFE OF ECONOMIC IMPORTANCE (2: 23/15)

Objectives

Understand various aspects of wildlife and use the knowledge to domesticate and semi domesticate animals for food production. Learn how to manage wild life under captive conditions.

Learning Outcomes

- Realize the wild life aspects and institutions and organizations involved with wild life.
- Determine the values of wild life to contribute for food production.
- Describe the management of wild life under captive condition.

Course Contents

Theory

Department of wild life and related institutions; Application of ecological principles related to management of terrestrial and aquatic habitats, principles of population dynamics in wildlife population and techniques used in study of wildlife; Taxonomy and habitats; food, feeding adaptation, pattern of reproduction, behaviour, production characteristics of economically important wild species; Concepts and effects of domestication and semi-domestication of wild species for food production; Management of wild life under captivity.

Practical

Visit to different ecosystems

Recommended Readings

1. Michael Modzelewski. January 31, 2012Farrar, Straus and Giroux (BYR).Wild Life [Kindle Edition]. Corvallis Press.
2. Modzelewski, M. (2012) Wild life.Corvallis Press.
3. Gloss, M. (2001) Wild life;Mariner Books. 1st Mariner Books ed edition.
4. Medin, D and Atran, S. (1999) Folkbiology (Bradford Books). The MIT Press
5. Adams, C.C. (1926) The economic and social importance of animals in forestry with special reference to wild life (Roosevelt Wild Life bulletin). 1st Edition. Roosevelt Wild Life Forest Experiment Station.

ANSS41062 ANIMAL BIOTECHNOLOGY (2: 30/00)

Objectives

Understand the aspects of biotechnology related to livestock production. Understand and use of biotechnology for selection, vaccine production, animal nutrition, and reproduction.

Learning Outcomes

- Describe the process of genomic analysis
- Use of biotechnology in selection of livestock
- Use of assisted reproductive techniques in increase the genetic gain
- Use of biotechnology in animal nutrition and animal health

Course Contents

Theory

Genomic analysis of farm animals, genetic markers, marker assisted selection, animal transgenesis, production of recombinant/molecular vectors, molecular vaccine, probes and monoclonal antibodies, assisted reproductive techniques, biotechnology in animal nutrition, feed additives, and manipulation of rumen fermentation.

Recommended Readings

1. Engelhard, M., Hagen, K and Boysen, M. (2010) Genetic Engineering in Livestock: New Applications and Interdisciplinary Perspectives (Ethics of Science and Technology Assessment). 1st ed. Springer; Softcover reprint of hardcover.
2. Gordon, I.R. (2003) Laboratory Production of Cattle Embryos. 2nd Edition (Biotechnology in Agriculture Series). CABI.
3. Renaville R. and Burny, A. (2001) Biotechnology in Animal Husbandry (Focus on Biotechnology). 1 edition. Springer.
4. Fiems L.O., Cottyn B.G . and Demeyer D.I. (1991) Animal Biotechnology and the Quality of Meat Production. Elsevier Science Ltd.
5. Symposium on Transgenic Technology in Medicine and Agriculture, Neal L. First, Florence P. Haseltine and Center for Population Research. (1991) Transgenic Animals: Proceedings of the Symposium on Transgenic Technology in Medicine and Agriculture (Biotechnology Series). Butterworth-Heinemann.
6. Food and Agriculture Organization of the 1989. (1989) Biotechnology for Livestock Production. 1 edition. Springer.
7. Moo-Young, M. (1989) Animal Biotechnology. 1st edition. Pergamon Pr.
8. Pinkert, C.A. Transgenic animal technology: a laboratory handbook. Online via Elsevier; Amazon.com
9. Renaville, R. and Burny, A. Biotechnology in Animal Husbandry. Kluwer Academic Publishers
10. Engelhard,M., Hagenand,K and Boysen,M. Genetic Engineering in Livestock. Kluwer Academic Publishers
11. Niemann, H., Kues, W. and Carnwath,W.J. Transgenic farm animals: current status and perspectives for Agriculture and Biomedicine1

ANSS41072 LACTATION PHYSIOLOGY (2:30/00)

Objectives

Understand the anatomy and the modification of mammary gland and hormonal influence on mammary development and mammary secretion and other related aspects.

Learning Outcomes

- Describe the anatomical modification of the mammary gland to carry out the physiological functions of mammary secretion.
- Demonstrate the hormonal influences on mammary development and milk secretion. Milk ejection and mechanics of milking.

Course Contents

Theory

Anatomy and development of mammary gland; Hormonal influences on Mammogenesis, Lactogenesis and Galactopoiesis. Milk ejection and mechanics of milking, Recent advances in lactation physiology.

Recommended Readings

1. Akers, R.M. (2002) Lactation and the Mammary Gland. 1st Edition. Wiley-Blackwell.
2. Larson, B.L., Anderson, R.R and Larson, B.L.L. (1996) Lactation. Iowa State University Press.
3. Garnsworthy. P. C. (1988) Nutrition and Lactation in the Diary Cow (Easter School in Agricultural Science//Proceedings). Butterworth-Heinemann
4. Peaker, M., Vernon, R.G. and Knight, C.H. (1984) Physiological Strategies in Lactation, Volume 51 (Symposia of the Zoological Society of London). Academic Press.
5. Whittemore, C.T. (1980) Lactation of the Dairy Cow (Longman Handbooks in Agriculture). Longman Group. United Kingdom

ANSS41082 RUMINANT NUTRITION (2:23/15)

Objectives

Understand the evaluation methods of feedstuff, recent advances in ruminant nutrition, determine the energy and protein requirements of animals, ration formulation for different functional group and efficient utilization of agricultural by –products.

Learning Outcomes

- Able to evaluate the feedstuff
- Use of recent advances in ruminant nutrition\
- Able to formulate ration for different functional groups of ruminants
- Use of agricultural by products in ruminant nutrition

Course Contents

Theory

Evaluation of the feed resources for livestock feeding; Recent advances in protein, energy and mineral nutrition, Estimation of energy and protein requirements and Formulation of rations for different functional groups and classes of livestock, Recent trends in utilization of agricultural by-products and fibrous feeds, Applied animal nutrition for small and large ruminants.

Practical

Feed evaluation, feeding trials, determination of anti-nutritional factors.

Recommended Readings

1. Doppenberg, J. and Piet van der Aa. (2010) Dynamics in Animal Nutrition.
2. Cheeke, P.R. (2004) Applied animal nutrition: feeds and feeding Prentice hall. 3rd edition
3. Greenhalgh, J.F.D., Morgan C.A., Edwards R. and Macdonald, P. (2002) Animal Nutrition. Pearson Education.
4. Alderman, G. (1993) Energy and protein requirement of ruminants. 1 edition.

ANSS41092 MONOGASTRIC NUTRITION (2:23/15)

Objectives

Better understanding about feedstuffs, digestion, ration formulation and feeding of monogastrics.

Learning Outcomes

- Able to classify feeds
- Describe the advanced techniques available to evaluate feeds
- Able to conduct digestion trials to determine digestibility
- Able to formulate ration
- Able to feed different stages of monogastrics.

Course Contents

Theory

Classification and nomenclature of feeds; evaluation of feeds, protein quality, feeding trials and balance experiments, Fiber digestion in monogastric animals; functions and requirements of minerals in poultry and pigs; formulation of mineral mixtures, Feeding ducks and rabbits; ration formulation for different functional groups of poultry and pigs, Factors affecting feed quality; Feed milling, grinding and mixing, feed spoilage, additives in feed processing, feed milling equipment; quality control in feed regulations for feed mill.

Practical

Visit to feed mills, determination of digestibility, formulating mash, crumble and pellet form rations. Quality control of rations.

Recommended Readings

1. Blas, C.D. and Wiseman, J. (2010) Nutrition of the Rabbit. 2nd edition .CABI
2. Klasing, K.S. (1998) Comparative Avian nutrition. 1st edition. CABI.
3. Subcommittee on Swine Nutrition, Committee on Animal Nutrition and National Research Council. (1998) Nutrient Requirements of Swine: 10th Revised Edition (Nutrient Requirements of Domestic Animals: A Series). National Academies Press.
4. Tony J. Cunha, T.J. (1977) Swine Feeding and Nutrition. Acadamic Press, Inc (London) Ltd. London.

5. HomerPatric, D.R. and Schaible, P.J. (1983) Poultry Feeds and Nutrition. AVI Publishing Company Inc, Westport, Connecticut.

ANSS41102 INTEGRATED ANIMAL PRODUCTION SYSTEMS (2:23/15)

Objectives

Understand the concept of crop – livestock integration and apply this under different circumstances to increase the efficiency of production.

Learning Outcomes

- Understand the concepts of crop –livestock integration
- Plan different systems of integration, to exploit the available resources
- Able to manage and utilize animal wastes.

Course contents

Theory

Model to describe crop-livestock integration, integration of livestock or fish with field crops, minor export crops, and other cash crops, animal waste utilization and management, Agro – silvo pastoral systems and other enterprises, livestock – fish integration.

Practical

Visit to different places to study the different integration systems and analyze the systems for sustainability and profitability.

Recommended Readings

1. **Prabakaran, R. (2004) Good Practices In Planning And Management Of Integrated Commercial Poultry Production In South Asia: Fao Animal Production And Health Paper #159. Food & Agriculture Org.**

2. Mathias, J.A., Charles, A.T. and Baotong, H. (1997) Integrated Fish Farming. 1st edition. CRC Press.
3. Thomas, V.M. (1992) Beef Cattle Production: An Integrated Approach. Waveland PrInc.
4. Hildebrand, R.E. and McDowell, P.E. (1980) Integrated crop and animal production: making the most of resources available to small farms in developing countries: a Bellagio conference, October 18-23, 1978 by McDowell, R. E., and Hildebrand, Peter E. Rockefeller Foundation.
5. Animal Production Research Unit Ministry of Agriculture. (1978) An Integrated Programme of Beef Cattle and Range Research in Botswana 1970-1977. Republic of Botswana.

Department of Agricultural Biology

AGBS 41012 INTEGRATED PEST MANAGEMENT (2:30/00)

Objectives

To impart knowledge oncore elements of pest management and the use of threshold values, use of pest population indices in decision making, role of environment to develop an IPM programme. different management techniques used against pests species, compatibility of methods to have effective pest management.

Learning outcome

At the end of the course students will be able to:

- Explain the importance and effectiveness of IPM and its advantages over the other management methods in existance.
- Assess pests damage and pest population and estimate the primary factor(s) influence the out-break of pest population,
- Develop IPM program for the pests

Course contents

History of pest management, Basic concept of IPM, Development of an IPM programme, Ecological principles in IPM, Economics of IPM, Tactics of IPM, Pest forecasting and prevention. Sampling methods, Life table studies and Case studies.

Recommended Readings

1) Koul, O., Dhaliwalal, G.S. and Cuperus, G.W. (2004) Integrated Pest Management: Potential, constraints and challenges.
2) Chanda's. (2000) South Asian Pest management. S.Chand and Company ltd, New Delhi.
3) Dent, D. (1996) Insect pest management. UK.
4) Koul, O., Dhaliwal, G.S. and Cuperus, G.W. (Eds.) (2004) Integrated pest management: potential, constraints and challenges. CABI.
5) Maredia, K.M., Dakouo, D. and Mota-Sanchez, D. (2003) Integrated Pest Management in the Global Arena. ZABI Publishing.

AGBS 41022 SOIL BORNE PATHOGENS (2:23/15)

Objectives

To impart knowledge on pathogens in soil, their etiology, pathogens and microbes in soil, rhizosphere and their potential, role of different management techniques used against soil borne pathogens

Learning outcome

- Explain the role of soil borne pathogens and their effect on crop plants
- Assess diseases caused by soil borne pathogens and their losses
- Develop integrated disease management for the pathogens in soil

Course contents

Theory

Etiology of soil borne pathogens, soil invaders and inhabitants, Host- pathogen relationship, Effect of soil environment on survival. Fungistasis, Rhizosphere, propagules, sclerotia, Competitive ability of pathogens, Disease suppression and Management of soil-borne plant diseases.

Practical

Isolation of soil borne pathogens, Identification and culturing of soil borne pathogens, Study on rhizosphere, sclerotia and other propagative materials, antagonism, suppression and management of soil borne pathogens

Recommended Readings

1) Dubey and Mageswary (1999) Text book of microbiology. Kalyani publications. New Delhi.

2) Bruehl, G.W. (1987) Soil borne plant pathogen. Mac Millan publishing co, New York.

3) Mukerji, K.G., Manoharachary, C. and Singh, J. (2010) Microbial Activity in the Rhizosphere (Soil Biology).

4) Agrios. G. N. (2004) Plant pathology. 5th edition. Academic press

5) Lee, D.L. (2002) The Biology of Nematodes. APS press.

6) Narayanasamy, P. (2001) Plant Pathogen Detection and Disease Diagnosis. Marcel Dekker.

AGBS 41032 BIOLOGICAL CONTROL OF PESTS (2:23/15)

Objectives

To impart knowledge on the role of bio agents in agro-ecosystem, bio agents and their potential in pest management, rearing/culturing of bio agents and their large scale production

Learning outcome

- Explain the role of bio agents in pest management

- Assess the effect of bio agents on pests and diseases of agricultural crops and medicinal plants
- Small and large scale production of bio agents and their commercialization

Theory

Biological agents, Practical approaches to evaluation of natural enemies, Classical biological control, Augmentation and inoculation with natural enemies, Conservation of predators, parasites and pathogens, Application of biological control to insect pests, Plant diseases and weeds, Case studies.

Practical

Collection and identification of natural enemies in the field (Predators and parasites), Isolation, Identification and culturing of entomo/acaro pathogens, Rearing techniques of predators and parasites under laboratory, Mass culturing of entomo/acaro pathogens, Experiment on entomo/acaro pathogens on insects and mites

Recommended Readings

1) Natural Enemies Handbook: The Illustrated Guide to Biological Pest Control
2) Paul DeBach (1973) Biological control of insect pests and weeds, Chapman and Hal
3) Nick J. Mills and Andrew P. Gutierrez (1999) Biological control of insect pests: a tritrophic perspective, Cambridge books
4) Jack E. Rechcigl, Nancy A. Rechcigl (eds.) Biological and biotechnological control of insect pests, CRC press

AGBS 41042 VERMITECHNOLOGY AND BIOWASTE MANAGEMENT (2:23/15)

Objectives

To impart knowledge onthe role of earthworm in agro-ecosystem, Vermitechnology, and bio waste management

Learning Outcome

- Explain the role of earthworm in agro-ecosystem
- Demonstrate the use of earthworms in waste management
- Demonstrate bio waste management

Theory

History of earthworms, role in agriculture, classification of earthworms, Morphological and anatomical characters used in classification, types of worms used in composting, vermicompost, vermiwash, preparation of vermicompost and vermiwash, biowastes, composting and waste recycling, degradation of biowastes using earthworms, other microorganisms such as *Pleurotus*, Effective microorganisms

Practical

Collection and identification of earthworms, their morphological characters and biology, Rearing techniques of earthworm, production of vermicast, vermiwash, Biowaste management of microorganisms, assessing effective microorganisms and other microbes inf waste management

Recommended Readings

1) Garg, V. K. and Gupta, R. (2011) Vermitechnology for Solid Waste Management: Vermitechnology -A sustainable technology, LAP LAMBERT Academic Publishing .

2) Kale, R.D. (1998) Earthworm: Cinderella of organic farming. A Prism book.

3) Bhatnagar, R.K. and Palta, R.K. (2002) Earthworm: Vermiculture and vermicomposting. Kalyani publishers, Ludhiana, India

AGBS 41052 INVERTEBRATE PATHOLOGY (2:23/15)

Objectives

To impart knowledge toexplain the role of insect/mite pathogens, use of pathogens in microbial control, microbial agents product development, storage and their effect on environment

Learning Outcome

- Explain the role of insect/mite pathogens in agro-ecosystem
- Demonstrate the use of insect/mite pathogens in pest control
- Develop bioagents in large scale production and their maintaining their standards

Theory

Pathogens of insects and mites, Types of diseases, Recognition and isolation of pathogenic microbes of insects, mites and nematodes, Maintenance of culture, Production and formulation of microbial pesticides, effect of environment on microbes, application in biotechnology, Bioethics in invertebrate pathology, Microbial pesticides used in IPM programmes.

Practical

Isolation and identification of insect/mite pathogens from field, Studying the morphological characters, etiology of insect/mite pathogens, Culturing techniques of insect/mite pathogens, Mass culturing, formulation of microbial agents, Experiments on insect/mite pathogens on insect pests/mites.

Recommended Readings

(1) Ekesi, S. and Maniania, N.K. (editors) (2007) Use of Entomopathogenic Fungi in Biological Pest Management. Research Signpost.

(2) Kalmakoff, J. and Longworth, J.F. (1980) Microbial control of insect pests. New Zealand Department of Scientific and Industrial Research, DSIR Bulletin 228.

(3) Lacey, Lawrence, A. and Kaya, H.K. (eds.) (2007) Field Manual of Techniques in Invertebrate Pathology: Application and evaluation of pathogens for control of insects and other invertebrate pests.

(4) Samson, R.A., Vlak, J. M. and Peters, D. (1986) Fundamental and applied aspects of invertebrate pathology. Society of Invertebrate Pathology.

AGBS 41062 MICROBIAL INOCULANTS IN AGRICULTURE (2:23/15)

Objectives

To impart knowledge on the role of microbes in agriculture, microbes as inoculants in agriculture, their potential as biofertilizers, bioagents, antagonistic potential and their commercial production.

Learning Outcome

- Explain the role of microbes as inoculants in agro-ecosystem
- Demonstrate the use microbes to strengthen the soil and growing media
- Demonstrate their small and large scale production

Course contents

Theory

History, agriculturally useful microorganisms, identification and techniques in mass culturing of biofertilizers–symbiotic nitrogen fixers (*Rhizobium* and Azolla), Blue green algae, Asymbiotic nitrogen fixers (*Azatobacter*, *Azomonas,Azospyrillum*, *Mycobacterium*) phosphate solubilizers, phosphate mobilizers, organic matter degraders, *Spirulina*, Vesicular Arbuscular Mycorhyzae (VAM) antagonistic organisms (*Trichoderma* spp. and *Pseudomonas florescence*), Field application of microbial inoculants.

Practical

Collection and identification of microbes, morphological characters, etiology of microbes, Culturing techniques of potential microbes, Experiments on microbes and their use, effect of antagonistic pathogens.

Recommended Readings

(1) Nirri Board. (2004) The complete technology book on biofertilizer and organic farming. National instirtute of industrial reseach, Delhi.

(2) Director General for Research. (ed.) (2011) COST Action 830: Microbial Inoculants for Agriculture and Environment. Dictus Publishing

(3) Hui-Lian Xu., Parr, J.F. and Umemura, H. (2000) Nature Farming and Microbial Applications. Routledge.

AGBS 41072 PLANT TISSUE CULTURE (2:30/00)

Objectives

To impart knowledge on the use of tissue culture and tissue culture techniques

Learning Outcome

- Explain the application of tissue culture
- Demonstrate the use of tissue culture techniques in crop improvement

Course contents

Theory

Definition Plant cell and tissue culture, applications, Organization of tissue culture laboratory, Tissue culture medium, Callus and cell culture, Cell suspension culture, Micro propagation, Organogenesis, somatic embryogenesis, haploid culture, embryo culture, protoplast culture, production of virus free plants, soma clonal variation, plant transformation and germplasm preservation. Bioethics.

Recommended Readings

1) Alberts, B., Johnson, A., Lewis, J. and Raff, M. (2007) Molecular Biology of the Cell, Garland Science.

2) Trigiano, R.N. and Gray, Dennis J. (2010) Plant Tissue Culture, Development, and Biotechnology, CRC press.

3) Neumann, K.H., Ashwani Kumar and Imani, J. (2009) Plant Cell and Tissue Culture - A Tool in Biotechnology: Basics and Application (Principles and Practice). springer.

4) Slater, A., Scott, N.W. and Fowler, M.R. (2008) Plant Biotechnology: The Genetic Manipulation of Plants, Oxford University Press, USA.

AGBS 41082 VERTEBRATE PEST MANAGEMENT (2:23/15)

Objectives

To impart knowledge on the damage caused by vertebrate pests, management of vertebrate pests

Learning Outcome

- Explain losses caused by vertebrate pests
- Demonstrate how vertebrate pests can be managed

Course contents

Theory

Vertebrate pests of crops, Rodent pests, severity of damage on crops and storage, rodent borne diseases, rodent management, other vertebrate pests of crops such as bats, wild boar, birds, squirrels and their management.

Practical

Identification of vertebrate pests, types of vertebrate pests and their damage at the field and storage, rodent management tools and methods, other vertebrate pests and their damage, traps used to manage vertebrate pests.

Recommended Readings

Frank Fenner and Bernardino Fantini (1999) Biological Control of Vertebrate Pests, CABI

AGBS 41092 APICULTURE (2:23/15)

Objectives

To impart knowledge on the role of various honey bees in agriculture, on beekeeping and promoting bee keeping in this region

Learning Outcome

- Explain the productiveness of honey bees and their products
- Demonstrate how beekeeping can be done effectively

Course contents

Theory

Types of honey bees, role of honey bees in agriculture, biology of honey bees, hive characteristics, division of labour, setting up of apiary unit, bee box, colonization and maintenance of bee colony, enemies of honey bees, nectar and pollen providing plants and products of honey bee.

Practical

Identification of different types of honey bees, Examining morphological characteristics of honey bees, Study on design and parts of honey bee box and other appliances, Setting of bee box and their enemies, nector and pollen yielding plants, Extraction of honey and wax.

Recommended Readings

(1) Conrad, R. and Nabhan, G.P. (2007) Natural Beekeeping: Organic Approaches to Modern Apiculture.Chelsea Green Publishing.
(2) Palmer, S., Norfolk, J. and Dolan, J. (2011) Bee keeping: a novice guide. 2nd edition.

AGBS 41102 MUSHROOM CULTIVATION (2:23/15)

Objectives

To impart knowledge on the role of mushroom in agriculture, on mushroom cultivation

Learning outcome

- Explain the productiveness of mushroom and promote mushroom cultivation
- Demonstrate how mushroom cultivation can be done effectively

Course contents

Theory

Types of mushroom, edible and poisonous mushroom, isolation and maintenance of mother culture, production of spawn, bedding procedures, harvesting and preservation of mushroom, pests of mushroom, techniques involved in mushroom cultivation, uses of mushroom in agriculture, quality maintenance.

Practical

Identification of different types of mushroom, Isolation, culturing of mother culture, production of spawn, bedding of mushroom, pests of mushroom, preservation of mushroom, use of mushroom in agriculture

Recommended Readings

1) Miles, P.G. and Chang, S.T. (2004) Mushrooms: Cultivation, Nutritional Value, Medicinal Effect, and Environmental Impact. CRC press.
2) Stamets, P. (2000) Growing Gourmet and Medicinal Mushrooms. Ten Speed Press.

AGBS 41112 GENETIC ENGINEERING (2:30/00)

Objectives

To impart knowledge on the role of genetic engineering in agriculture, on the techniques involved in genetic engineering

Learning Outcome

- Explain the potential of genetic engineering in agriculture
- Demonstrate how genetic engineering could be done

Course contents

Theory

Genetic material, DNA isolation, DNA sequencing, gene cloning, vector construction, promoters, reporter genes, selectable markers, T-DNA, gene transfer methods, selection, marker-free transformation, gene stacking, transgenics in crop improvement, expression of transferred genes, gene silencing, isolation of protein and RNA, GUS assay, gel electrophoresis, PCR, RT-PCR, Southern blot, Northern blot, Western blot, safety measures, genomics, bioethics.

Recommended Readings

(1) Slater, A., Scott, N.W. and Fowler, M.R. (2008) Plant Biotechnology: The Genetic Manipulation of Plants. Oxford University Press, USA.
(2) Starr, C., Taggart, R., Evers, C. and Starr, L. (2008) Cell Biology and Genetics. Brooks cole.

AGBS 41122 TRANSGENICS IN CROP IMPROVEMENT (2:30/00)

Objectives

To impart knowledge on the role of transgenics in crop improvement, on the techniques in transgenic development

Learning Outcome

- Explain the potential of transgenics in agriculture
- Demonstrate how transgenics could help in crop improvement

Course contents

Theory

Sources of genetic materials, agriculturally useful traits, integration and expression, resistance to insect, disease and virus, herbicide resistance, tolerance to abiotic stresses, transgenic for improved storage, keeping quality, colour and shape, transgenic for male sterility, transgenic plants as bioreactors, assessment of transgenic crops, commercial transgenic crops, impact of transgenic crops and recombinant DNA technology, intellectual property rights, bioethics

Recommended Readings

(1) Craig Holdrege and Steve Talbott (2008) Beyond Biotechnology: The Barren Promise of Genetic Engineering (Culture of the Land), The University Press of Kentucky
(2) Adrian Slater, Nigel W. Scott and Mark R. Fowler (2008) Plant Biotechnology: The Genetic Manipulation of Plants, Oxford University Press, USA
(3) Kirsi-MarjaOksmanCaldentey and Wolfgang Barz (2002). Plant Biotechnology and Transgenic Plants, Marcel Dekker

AGBS 41132 PLANT BIOTECHNOLOGY (2:30/00)

Objectives

To impart knowledge on the role of plant biotechnology in agriculture, the techniques used in biotechnology

Learning Outcome

- Explain the potential of biotechnology in agriculture
- Demonstrate how plant biotechnoloty could help in improving agriculture

Course contents

Theory

Importance of plant biotechnology in agriculture, requirements for *in-vitro* cultures, organization of *in-vitro* culture laboratory, sterilization techniques, nutrition medium, methods of plant cell, tissue and organ culture, types of cultures of plant materials, protoplast isolation and fusion, somaclonal variation, induction of polyploidy, *in-vitro* mutagenesis, genetic engineering, transgenic plants, germplasm storage and cryopreservation, bioinformatics, industrial plant biotechnology, career opportunities in plant biotechnology.

Recommended Readings

1) Qaim, M., Krattiger, A.F. and Braun, J.V. (2000) Agricultural Biotechnology in Developing Countries: Towards Optimizing the Benefits for the Poor. Springer.

2) Ryu, D.D. and Furusaki, S. (1994) Plant Biotechnology. Elsevier.

3) Caldentey, K.M.O. and Barz, W. (2002). Plant Biotechnology and Transgenic Plants, Marcel Dekker.

4) Holdrege, C. and Talbott, S. (2008) Beyond Biotechnology: The Barren Promise of Genetic Engineering (Culture of the Land). The University Press of Kentucky.

5) Slater, A., Scott, N.W. and. Fowler, M.R. (2008) Plant Biotechnology: The Genetic Manipulation of Plants. Oxford University Press, USA.

Department of Agricultural Chemistry

ACHS 41012 LAND EVALUATION AND GIS APPLICATIONS (2: 15/30)

Objectives

The aims of the course is to impart knowledge about land resources and their sustainability, principles of land evaluation and GIS and its application in land evaluation

Learning Outcomes

- Explain about land resources and their sustainability
- Explain about land evaluation
- Describe and execute GIS software to perform land evaluation

Course Contents

Theory

Land resource issues and concerns, types of land resources, Land use change and its impacts, Aspects of soil fertility, Concept of sustainability, Soil quality indicators, land evaluation, FAO system of land evaluation and framework for evaluation of sustainable land management, GIS applications in land evaluation and sustainable land management.

Practical

Introduction to Arc view GIS, projects, views and themes, types of themes, tables, charts, scripts, adding themes to a view, moving around in a view, redefining a theme, projections, working with theme attributes, working with tables, labeling features in views, adding one's own features, layouts, spatial analysis, mini project.

Recommended Readings

1. Davidson, D.A. (1992) The Evaluation of Land Resources. Longman Publication Group, 2nd Edition, 1992.
2. FAO. (1993) Guidelines for Land-Use Planning. FAO, Rome.
3. FAO. (1995) Guidelines: Land Evaluation for RainfedAgriculture, FAO Soil Bulletins NO. 52, Rome.
4. FAO. (2007) Land Evaluation: towards a revised framework, Land and Water Discussion Paper 6. Rome.
5. Young, A. (1998) Land Resources: Now and for the Future, Cambridge University Press, Cambridge.
6. Singer,M.J and Munns,D.N (2002) Soils an introduction. 5th edition, Prentice Hall, New Jersey.
7. Cys, C., Van Ranst, E. and Debaveye, J. (1991) Land Evaluation Part I, II and III. Agricultural Publications, Belgium.
8. Lo, C.P. Albert, K.W. and Yeung (2007) Concepts and Techniques of Geographic Information Systems. 2nd Edition, PHI Learning Private Ltd. New Delhi
9. Clarke, K. C., Parks B.O., and, Crane, M.P. (2002) Geographic Information Systems and Environmental Modelling. Prentice Hall, Inc.
10. Debashis, C and Rabi, N.S. (2007) Fundamentals of Geographic Information system. VIVA books.

ACHS 41022 SOIL AND PLANT ANALYTICAL TECHNIQUES (2: 23/15)

Objectives

The course is designed to provide knowledge about sampling and handling of soil, plant, manure and water samples, different analytical techniques used in soil plant and water samples.

Learning Outcomes

- Describe and demonstrate about sampling and handling of soil, plant, manure and water samples
- Perform different analytical techniques in soil plant and water samples.

Course Contents

Theory

Sampling, handling and storage of soil, plant, manure and water samples, Errors, precision and accuracy, extraction of nutrients from soil and plant samples, Instrumentation: colorimetry, spectrophotometry, flame emission and atomic absorption spectroscopy, potentiometry, conductimetry, tracer techniques.

Practical

Mini project on sampling and analysis of soil and plants

Recommended Readings

1. Tan, K.H. (2005) Soil Sampling, Preperation and Aanalysis. 2nd Ed. Taylor and Francis Group, LLC.
2. Gupta, P.K (2007). Soil, Plant, water and Fertilizer Analysis 2nd Edition. Agribiosos.
3. Black, C.A., Evans, D.D., White, J.L., Ensminger, L.E and Clark, F.E. (1965) Methods of Soil analysis Part I American Society of Agronomy. Inc., Publisher, Madison , Wisconson, USA.

ACHS 41032 LAND DEGRADATION MANAGEMENT AND GIS APPLICATIONS (2: 15/30)

Objectives

The course is directed towards imparting knowledge about role of land resources, causes and effects of land degradation, types of land degradation, assessment of land degradation and to impart skills to use GIS and its application in assessment of land degradation

Learning Outcomes

- Describe and identify different land degradation issues including the causes and effects
- Assess the degree of land degradation
- Exploit GIS software to assess and manage land degradation issues

Course Contents

Theory

Functions of land in the ecosystem, causes and effects of land degradation including human impacts, types of land degradation: erosion, fertility decline, desertification, salinization, acidification, soil pollution, water quality degradation, farmer perspective of land degradation, field assessment, application of GIS in land degradation monitoring and management

Practical

Introduction to Arc view GIS, projects, views and themes, types of themes, tables, charts, scripts, adding themes to a view, moving around in a view, redefining a theme, projections, working with theme attributes, working with tables, labeling features in views, adding one's own features, layouts, spatial analysis, mini project.

Recommended Readings

1. Lo, C.P. Albert, K.W. and Yeung (2007) Concepts and Techniques of Geographic Information Systems. 2nd Edition, PHI Learning Private Ltd. New Delhi.
2. Lal, R. (1997). Degradation and resilience of soils. Phil. Trans. R. Soc. London. B 352, 869-889.
3. Morgan, R.P.C. (1996) Soil erosion and conservation. Longman Scientific & Technical, Harlow, Essex, England.

4. Clarke, K. C., Parks, B.O. and, Crane, M.P. (2002) Geographic Information Systems and Environmental Modelling. Prentice Hall, Inc.
5. Debashis, C and Rabi, N.S. (2007). Fundamentals of Geographic Information system. VIVA books.
6. Eswaran, H., Lal, R. and Reich P.F. (2001) Land degradation: an overview. In: Bridges et al (eds.). Responses to Land Degradation. Proc. 2nd. International Conference on Land Degradation and Desertification, KhonKaen, Thailand.

ACHS 41042 LAND RESOURCES AND ENVIRONMENTAL ISSUES (2: 30/00)

Objectives

The course is structured to make students to understand regarding Local Regional and global environmental issues and related International conventions and to enrich the knowledge about Land, water and Air pollution and management.

Learning Outcomes

- Describe local legional and global environmental issues and related International conventions.
- Describe land resource pollution and management

Course Contents

Theory

Local Regional and global environmental issues, International conventions: Convention to combat desertification, Convention on Biodiversity Conservation, Convention on Climate Change, Wetland convention, Land, water and Air pollution and management. mitigation and adaptation in land use for climate change management.

Recommended Readings

1. Lal, R., Kimble, J.M, and Follet, R. (1995). World soils as a source or sink for radiatively- active gases. In Lal, R., Kimble, J., Levine, E. and Stewart, B. (eds).Soil

management and green house effect. Advances in soil science. Lewis Publishers, Boca Raton, FL.

2. Lal, R., Kimble, J.M. and Follet, R. (1997) Land-use and soil C pools in terrestrial ecosystems. In Lal et al (Eds) Management of carbon sequestration in soils. CRC Press New York, Washington DC.
3. Robert, M. (2001) Carbon sequestration for improved land management. World soil resources report 96. FAO, Rome.
4. Srivastava, J.P., Smith, N.J.H. and Forno, D.A. (Eds.). (1996) Biodiversity and Agricultural Intensification: Partners for Development and Conservation. Environmentally Sustainable Development Studies and Monographs, Series no. 11, World Bank, Washington, DC USA.

ACHS/AGBS 41012 SOIL BIOLOGY AND FERTILITY (2: 23/15)

Objectives

The course is aimed to gain knowledge about soil micro and macro organisms, bio-geo cycles and their effects on fertility, to study the usage of soil organisms to enhance soil fertility and pest management to acquire knowledge about bioremediation

Learning Outcomes

- Indentify and describe soil micro and macro organisms
- Explain Bio-geo cycles and their effects on fertility
- Isolate and enumerate microbes in soils and estimate microbial biomass
- Produce compost using earthworm
- Describe bio fertilizers and bioremediation techniques

Course Contents

Theory

Soil micro and macro organisms: Diversity, isolation and dynamics. soil organic matter dynamics, microbial biomass, Bio-geo cycles and their effects on fertility, Rhizpsphere, Symbiosis of plant and microbes, Soil organisms and environment, composting and organisms, bio-fertilizers and bioremediation.

Practical

Determination of microbial biomass, soil organic matter fractions**,** isolation and enumeration of soil bacteria and fungi, vermi compost and vermi wash.

Recommended Readings

1. Sharma, A.K. (2009) Biofertilizers for sustainable agriculture. 1st Edition. Agrobios.
2. Cappuccino, J.G. and Sherman, N. (2002) Microbiology: Laboratory manual. Pearson Education, Inc.
3. Kathireswari, P. (2010) Soil Biota. Agrobios, India.
4. Purohit, S.S. (2004) Microbiology, Fundamentals and applications. 6th edition, Agrobios, India.

ACHS 41052 FOOD PRESERVATION TECHNOLOGY (2:30/00)

Objectives

This course aims to provide the knowledge of principles and major methods of food preservation and processing, new technologies including thermal/non-thermal and radioactive processing, extrusion, minimal processing and other advanced processing methods

Learning Outcomes

- Describe and contrast the principles and methods of classical and advanced methods of food preservation and processing and the changes in qualities of food brought about by these operations
- Describe and contrast different packaging materials available to the food processing industry and explain the reasons for packaging food

Course Contents

Theory

Low temperature preservation technology (chilling, freezing), thermal processing (blanching, pasteurization, in-container sterilization, aseptic processing, frying, baking,),extrusion technology, preservation through water removal (evaporation, dehydration, freeze drying, freeze concentration, membrane concentration), irradiation of food, microwave heating of foods, controlled and modified atmospheric storage, principles and application of hurdle technology, new and emerging methods of food preservation (ohmic heating, hydrostatic pressure, high voltage electric pulses).

Recommended Readings

1. Fellows, P. (2009) Food processing Technology, *Principles and Practice*, 3rd edition, Woodhead publishing.
2. Sahu, J.K. (2012). Introduction to Advanced Food Processing Technologies, CRC Press.
3. Sun. D. (2012). Thermal Food Processing, CRC Press.
4. Sivasanker, B (2002) Food processing and preservation, Prentice-Hall of India private Limited, New Delhi, India
5. Potter, N.N. and Hotchkiss, J.H., (1996) Food Science, CBS Publishers and distributors, India

ACHS 41062 FOOD ANALYSIS (2:20/20)

Objectives

The objective of this course is to expose the students to the principles, methods, and techniques of qualitative and quantitative physical, chemical and biochemical analyses of foods and to familiarize them in handling analytical instruments and teamwork in a food analysis laboratory

Learning Outcomes

- Apply statistical principles in sampling and assess analytical methods and data

- Describe the principles used to determine moisture, carbohydrate, lipid, proteins, ash, mineral, and vitamin content of a food conduct proximate analyses
- Discuss the principles and methods of advanced food analyzing techniques
- Handle the laboratory equipments for food analysis
- Work in group and write concise laboratory reports

Course Contents

Theory

Food sampling and sample preparation, Assessment of analytical methods and data, Safety in the food analysis laboratory, Sensory analysis of food, Microscopy of foods, Drinking water analysis, Chromatographic methods of food analysis: paper, thin layer, coloumn, HPLC and GLC, Spectrophotometric methods: UV visible, flame and atomic absorption, Analytical methods of carbohydrates, proteins, fats, vitamins and minerals, Analysis of food additives and contaminants, Application of enzymes in food analysis, Immunoassays

Practical

Sampling and sample preparation of foods, sensory evaluation of food samples, introduction to chromatography techniques (Paper chromatography, TLC, GC, HPLC) of food analysis, determination of major and minor constituents of foods and contaminants.

Recommended Readings

1. Nielsen, S.S. (2003) Food Analysis, 3rd edition, Plenum Publishers, New York
2. Shewfelt, R.L. (2009) Introducing food science, CRC Press, New York
3. Nielsen, S.S. (2002) Introduction to the chemical analysis of foods, CBS Publishers and Distributors, New Delhi
4. Ramasamy, M. (2000) Treatise manual of food analysis, 2nd edition, Print Graphics, Sri Lanka
5. Apenten, R.O. (2005) Introduction to food chemistry, CRC Press, New York

6. Jacobs, M.B. (1999) The chemical analysis of foods and food products, 3rd edition, CBS Publishers and distributors, New Delhi
7. Pomeranz, V. and Meloan, C.E. (1996) Food analysis: Theory and practice, 3rd edition, CBS Publishers and distributors, New Delhi

ACHS 41072 FOOD PROCESSING (2:23/15)

Objectives

The aim of the course is to provide the knowledge of principles and practices of the major techniques used in processing and preservation of various food items and utilization of waste products.

Learning Outcomes

- Describe the principles of food preservation and apply the principles to commodities to achieve preservation
- Describe the principles of various food processing techniques
- Apply the principles of food process techniques to specific commodities and recognize the effects of processing parameters on product quality attributes
- Recognize the benefits of waste management

Course Contents

Theory

Suitability of raw materials for food processing, processing of fruits and vegetables, cereals, nuts, palm products, spices and condiments, postharvest storage of fruits and vegetables, food packaging, canning operations, minimal processing, non-alcoholic beverages processing technology, application of nanotechnology in food industry, utilization of agricultural products processed wastes.

Practical

Field visits to various food processing industries.

Recommended Readings

1. Shewfelt, R.L. (2009) Introducing food science, CRC Press, New York
2. Fellows, P. (2009) Food processing Technology, *Principles and Practice*, 3rd edition, Woodhead publishing.
3. Sivasanker, B. (2002) Food processing and preservation, Prentice-Hall of India private Limited, New Delhi, India
4. Blank, F.C. (2007) A hand book of foods and nutrition, Agrobios, India
5. Potter, N.N and Hotchkiss, H.H. (1996) Food Science, CBS Publishers and distributors, Delhi, India
6. Sivasanker, B. (2002) Food processing and preservation, Prentice-Hall of India private Limited, New Delhi, India
7. Aylward, F. (2001) Food technology: Processing and laboratory control, Agrobios, India.
8. Blank, F.C. (2007) A hand book of foods and nutrition, Agrobios, India

ACHS 41082 FOOD AND NUTRITION (2:23/15)

Objectives

This course aims to provide knowledge of Sri Lankan and global nutritional status, nutritional disorders, detrimental effects of some food habits and importance of functional and organic foods in human nutrition.

Learning Outcomes

- Describe the global and Sri Lankan nutritional status and methods to assess the nutritional status
- Describe the digestion and absorption of major components of diet in human body
- Describe the main issues of concerns related to alcohol consumption and junk foods
- Describe the role of fiber, organic and functional foods and vegetarianism in human health

- Describe malnutritional problems and their causes and preventive measures, other food related disorders, food allergens and food toxins

Course Contents

Theory

Global and Sri Lankan nutritional status, energy giving, body building and regulatory foods, digestion and absorption of nutrients, alcohol in nutrition, deleterious effects of alcohol consumption, role of fibre in nutrition, organic foods, functional foods, junk foods, vegetarianism, toxic substances in foods, food allergens, food consumption pattern and nutritional deficiency diseases and other disorders, nutritional assessment methods.

Practical

Anthropometric assessment of nutritional status of people of different stages of life cycle, market survey on commercial breast milk substitutes, baby foods, health foods, energy and body building foods, study on food consumption pattern and nutritional knowledge on school children

Recommended Readings

1. Brown, J.E. (2005) Nutrition now, 4th edition, Thomson Learning, Inc.
2. Berdanier, C.D., Dwyer, J.T. and Feldman, E.B. (2007). Handbook of Nutrition and Food, 2nd Edition, CRC Press.
3. Bender, D.A. (2008) Introduction to nutrition and metabolism, 4th edition, CRC Press, New York
4. Wikrmanayake, T.W., (1995) Food and Nutrition, Hecter Kobbekaduwa Agrarian research and training institute, Colombo, Sri Lanka.
5. Damodaran, S., Parkin, K.L. and Fennema, O.R. (2008) Fennema's Food Chemistry, 4th edition, CRC Press, New York
6. Whiteny, E.N. and Sizer, F.S. (1994) Nutrition: Concepts and controversies, 6th edition, West publishing company, St Paul.
7. Sabate, J. (2001) Vegetarian Nutrition, CRC Press, New York.

8. Spallholz, J.E. (1989) Nutrition chemistry and biology, Prentice-Hall, Inc.
9. Shubhangini, A.J. (2010), Nutrition and dietetics, 3rd edition, Tata McGraw-Hill publishing company limited, New Delhi.
10. Guo, M. (2009). Functional Foods: Principles and Technology, CRC Press.

ACHS 41092 FOOD PRODUCT DEVELOPMENT (2:00/60)

Objectives

This course aims to provide experience in handling the food product development procedure as it is related to the food industry and to acquire hands-on skills in different industrial equipments and food processing methods and provide fundamental knowledge of food sanitation and storage. Emphasis will be on application of basic knowledge of foods and food processing in designing a new product.

Learning Outcomes

- Handle the industrial food processing equipments
- Apply their knowledge in different food processing operations in safe and hygienic way
- Demonstrate practical proficiency and team work in a food processing industry
- Write a report on various aspects of an industry
- Apply their knowledge in developing new value added food products**.**

Course Contents

Practical

In this course each student has to work in a food and related products processing industry by spending minimum of 4 hours per week. During this course of study student assess the various aspects of processing, hygiene and storage of different food products produced by the industry.

In addition they will be trained on identification of food ingredients, properties and application in product development, production of jam, jelly, cordial and sauces, preservation of fruit pulps, development of dehydrated fruits and vegetables, confectionaries, cereal based products and nutritional supplementary foods.

Recommended Readings

1. Earle, M., Earle, R. and Anderson, A. (2001). Food product development, CRC Press, Wood Head Publishing Ltd.
2. Shewfelt, R.L. (2009) Introducing food science, CRC Press, New York
3. Fuller. G. W. (2011). New Food Product Development; From Concept to Market place, 3rd ed., CRC Press.
4. Aylward, F. (2001) Food technology: Processing and laboratory control, Agrobios, India.

AENS 41012 ENERGY, ENVIRONMENT AND WASTE MANAGEMENT (2:23/15)

Objectives

The aim of the course is to provide the knowledge and skill on energy, environment and waste management in order to keep clean environment, which has direct impact on safety, security and stability of human life.

Learning Outcomes

- Combine basic scientific processes of energy flow, environmental components, functions and advance techniques for waste management
- Identify and solve the environmental problems.

- Preserve clean environment by implementing planning process, environmental impact assessment, environmental regulations and environmental control parameters.
- Manage & dispose solid waste in an eco-friendly manner.
- Select suitable waste treatment methods for Animal and Fish waste
- Design the waste treatment unit for a farm or processing plant

Course content

Theory

Renewable and non-renewable energy, Solar energy and solar cell, Electro-magnetic energy radiation, energy balance, solar heating, and heaters, photoelectric cell, Environment and its functions. Advance methods for waste deposal and e-waste and its disposal, energy recovery from Biomass, Bio-fuel, Energy storage, Geothermal energy , Bioreactor design and control of bio-environment, Advancement in waste treatment: Ponds and lagoons, Aerobic treatment, Physical and chemical treatment, Biological treatment. Landfill design and operation

Practical

Sewage plant design, Trickling filter design, Sedimentation tank design, Energy recovery calculations from biomass and biodegradable waste materials, Design of hydropower plant and its operation

Recommended Readings

1) Frank, K. (1994) Hand book of Solid waste management. McgrawHillInc publishers, New York.

2) Kormondy, E.J. (2003) Concept of Ecology. 4th edition. Prentice Hall of India.

3) Frances drake, J. (2000) Global warming. OxfordUniversity press Inc, New York.

4) Davis, M.L. and Cornwell, D.A. (1991) Interdiction to Environmental Engineering. 2nd edition. Mcgrow hill Inc, New Delhi.

5) Agarwal, V.K. and Verma, P.S. (1996) Environmental Ecology. S.Chand and company ltd New Delhi.

6) Banerji, S.K. (1999) Environmental chemistry. 2nd edition. Prentice Hall of India.

7) Davis, M.L and Cronwell, D.A. (1991) Interdiction to environmental engineering. 2nd edition. Mcgraw Hill Inc, New Delhi.

AENS41022 FOOD PROCESSING ENGINEERING (2:23/15)

Objectives

The aim of the course is to provide the knowledge of engineering properties of food in handling, processing, and storage at various stages to produce better with low losses.

Learning Outcomes

- Apply the principals of food engineering in various food processing operations to produce good quality value added product.
- Compare losses during processing of various foods
- Examine quality characteristics of different foods

Course content

Theory

Physical characteristics of food materials, Fluid flow in food processing, energy for food processing and heat transfer in food processing, microbial survival curves, unit operations in food processing, mass and energy balance calculations in food process engineering, Food freezing, evaporators and their design

Practical

Estimation of overall heat transfer coefficient, Applications of cleaner production in food engineering, Use of microbial survivor curves in food engineering, Food freezing time determination, Design of single and multi-effect evaporators.

Recommended Readings

1) Sign, R.P, and Heldman, D. R. (2001) Department of Food process Engineering. University of California.

2) Rao, M.A. and Rizvil, S.S.H. (1994) Engineering properties of food. 2nd edition. New York.

3) Lewis, M.J.C. (1987) Physical properties of food and food processing system. Weinheim.

4) Okos, M.R. (1986) Physical and chemical properties of food. American society of Agricultural Engineers.

5) Juliano, B.O. (1996)Physico chemical Data on Rice Grain. Technical Bulletin 6, International Rice Research Institute, Los Banos, Philippines.

AENS 41032 HYDROLOGICAL MODELING OF RAINFALL AND RUNOFF (2:30/00)

Objectives

The aim of the course is to explain the water related applied science comprising occurrence, circulation, utilization, distribution and water storage, to learn the concept of hydro-graph theories involves natural disasters, its prevention and prediction, to understand the principles of flood control and planning for flood control, To study the principles of reservoir flood routing and river flood routing.

Learning Outcome

- Build up their modeling skill in rainfall runoff model fitting.
- Elaborate the natural disasters due to rainfall and flood.
- Develop stimulation models of rain fall and runoff.

Course content

Theory

Hydrograph - Hydrograph analysis, derivation of unit hydrograph, S- Hydrograph, Synthetic unit hydrograph, dimensionless unit hydrograph, Reservoir routing and flood routing**;** Importance of flood estimation, Inflow out flow relationship, flood routing by puls method, kelman method and integration method, River flood routing Muskingum method and Wilson's method. Computer modeling; properties of hydrologic models, mathematical modeling, model calibration, model verification, classification model- Block box model, conceptual model, lumped model, deterministic model, conceptual stochastic model. Rainfall Runoff models**.**

Recommended Readings

1. Sharma, R.K. (1993) A text book of hydrology and water resources. Shriganesh offset Press, Shahdara, Delhi.
2. Ghanshyan, D. (2000) Hydrology and Soil Conservation. Prentic Hall of India.
3. Wanielista, M.P. (1990) Hydrology and water quality control. John Wiley and sons New york.
4. Davis, M.L. and Cornwell, D.A. (1991) Interdiction to Environmental Engineering. 2nd edition Mcgrow hill Inc. New delhi.

AENS 41052 ENGINEERING MECHANICS (2:30/00)

Objectives

The aim of the course is to make the students familiar with force analysis of structures used in agricultural operations. Further, it is to provide the knowledge about stress-strain relationship of various structures. In addition, force analysis of fluids through the pipes is also taught to regulate and organize the design of irrigation structures.

Learning outcomes

- Explain stress-strain relationship of various structures
- Compare force analysis of various fluids in motion through pipes
- Develop stable farm structures
- Select appropriate materials for structural development

Theory

Importance of mechanics, stress-strain relationship, Fluid flow and forces due to friction, Energy equations in engineering mechanics, young module, elastic constant, type of stress torsion, beam capacity & deflection, fluid flow, laminar & turbulent flow, momentum equation & its application, flows in pipes, kinematics & dynamics, velocity acceleration diagram, belt drive, vibration & its effect, fluid machinery, dimensional analysis and hydraulic similitude, continuity and energy equations & their applications in fluid mechanics.

Recommended readings

1. Bansal, R.K. (2005). A Text book of Engineering Mechanics, Luxmi Publications.
2. Bhavikatti, S. S. and Rajashekarappa, K. G. (1994).New Age International, New Delhi.
3. Bhavikatti, S. S. and Vittal, H.A. (2005). Problems Solutions in Engineering Mechanics, New Age International, New Delhi, pp-201
4. Meriam, J. L., & Kraige, L. G. (2012). Engineering mechanics: dynamics (Vol. 2). John Wiley & Sons.

5. Hibbeler, R. C. (1995). Statics. Mac Millan publishers.

AENS 41062 Electrical Power & Machines (30/00)

Objectives

This is to provide fundamental concepts of electrical power used in agricultural machineries and to provide knowledge about economic usage of electricity to operate various machines in an efficient manner

Learning outcomes

- Measure AC voltages and currents.
- Make use the electrical circuit analysis of machinery for better operation.
- Analysis various machines economically during the peak and average demand of electricity.

Theory

Introduction to electrical system of machines, Importance of electrical system, Components of electrical system, Electrical power generation, Measurement of AC voltages and currents, Average and RMS values, Use of complex numbers in AC circuit analysis, transformers, Measurement of AC power, DC and AC motors, Generators and Electricity demand analysis.

Recommended readings

1. Theodore, W. (2007). Electrical Machines, Drives and Power Systems, Dorling Kindersley (pvt) Ltd, India.
2. Philip, K. (2003). Electrical Equipment Handbook: Troubleshooting and Maintenance, McGRAW-HILL: New York, Chicago, San Fracisco, Lisbon, London
3. Chapman, S. J. (2001). Electric Machinery and Power System Fundamentals, Instructor's Manual to accompany Electric Machinery and Power System Fundamentals, First Edition, United States of America.
4. Blume, S.W. (2007). Electric power system basics for the Nonelectrical Professional, John Wiley and Sons, Inc., Hoboken, New Jersey.

5. Sen, P.C. (1997). Principles of Electric machines and Power Electronics, John Wiley and Sons Pvt ltd, New York, Singapore, Toronto.

AENS 41072 CLEANER PRODUCTION TECHNOLOGY (2:30/00)

Objectives

This course has a structure related to cleaner production since waste is generated by various industrial processes all over the world. Agriculture & food processing play a key role in waste generation in Sri Lanka. Management of waste after generation is difficult and expensive. In addition, considerable quantity of input is also wasted, if the technology for particular process is inappropriate. This cause is therefore to provide knowledge about cleaner production technology for better input utilization, minimum waste generation & environment protection.

Learning outcomes

- Describe the industrial & environment interaction
- Illustrate cleaner production options for better production and safe environment
- Apply cleaner production concepts to investigate industrial processes

Theory

Definition to cleaner production, Importance of cleaner production for better environmental protection, Evaluation of unit operation of cereal, fruit, vegetable, milk & meat products, Processing using cleaner production techniques, such as, mass & energy balance sheet analysis, development of cleaner production options for various food processing plant, Cleaner production team formulation for monitoring of processing plant, Energy recovery from industrial wastes, Environmental sustainability, Introduction to global warming & zero emissions, Introduction to methods & tools of cleaner production, Introduction to low carbon technology, Carbon-neutral technology & practices, Cleaner production barriers & driving forces, Introduction to environmental auditing.

Recommended readings

1. Pauli, G. (2011). Deep Ecology to The Blue Economy, Gelesenbei ZERI

2. Schaltegger, S., Bennett, M., Burritt, R. and Jasch, C. (2008). Environmental Management Accounting as a Support for Cleaner Production, Dordrecht Springler.
3. Yacooup, A. and Johannes, F. (2006). Half is enough- An introduction to cleaner production, LCPC Press, Beirut, ISBN 978-3-9501636-2-9.
4. Clayton, T., Spinardi, G., and Williams, R. (2014). Policies for cleaner technology: a new agenda for government and industry. Routledge.

AECS 41022 INTERNATIONAL TRADE AND MONETARY ECONOMICS (2:30/00)

Aim

To provide the theoretical foundations of International Trade and International Monetary Economics, The course introduces theories of international economics and their application. The trade section presents models of why countries trade & explores why governments may restrict free trade. The finance section introduces models of exchange rate determination, describes government financial intervention with monetary policy, and shows how one may assess costs and benefits of various exchange rate regimes.

Objectives

- Distinguish between different models of international economics by their assumptions
- Describe and compare the main features and results of the different models
- Develop the comparative statics within the economic models of international economics covered in the course
- Explain the outcome of comparative statics in terms of model mechanics and assumptions
- Interpret theoretical and analytical skills to diagnose, describe and analyze agricultural trade policy problems;
- Distinguish theoretical and analytical skills to analyze and evaluate the impacts of the contemporary trade policy options available to policy-makers;
- Describe the analytical skills to analyze the economic and welfare effects of trade policies;

Course content

Theory

The instruments of Trade policy, The impact of Trade policies, Economic integration, The Balance of payment accounts, The foreign exchange market,Economic policy in the open economy regimes, the Mundell – Fleming model and the exchange grade regime.

Recommended Readings

1) Daniels, J.P. and Hoose, D.V. (2002) International Monetary and Financial Economics. South western Thomson Learning.
2) Appleyard, F. and cob. (2006)International Economics, McGraw-HIll press.
3) Salvatore, D. (2004) International Economics. John wiley and Sons.
4) Houck, J.P. (1992) Elements of Agricultural Trade policies, Waveland press.

AECS 41032INTRODUCTION TO MANAGEMENT SCIENCE AND LINEAR PROGRAMMING (2:30/00)

Aim

Aim of this course is to expose students to a variety of problems that have been solved successfully with management science methods and to give students with experience in modelling these problems in the Excel Spreadsheet package. Intent of this course is to emphasize the applied aspects of management science.

Objectives

- Formulate mathematical models for business problems
- Demonstrate skills in using spreadsheets (in particular, Microsoft EXCEL) to implement appropriate quantitative techniques for business decision-making.
- Solve an optimization model in a spreadsheet using the Excel add-in solver.
- Perform sensitivity analysis.

- Apply the results from quantitative analysis to support business decision making and problem solving.

Course content

Theory

The Nature of management Science**,** Linear programming Basic concepts**,** The art of modeling with spreadsheets**,** Linear programming Formulation and application What- If analysis for Linear programming**,** Transportation and Assignment problems.

Recommended Readings

1) Hillier, F.H.M. (2013) Introduction to Management Science.McGraw-Hill/Irwin.
2) Denardo, E.V. (2011) Linear Programming and Generalizations: A Problem-based Introduction with Spreadsheets. Springer.
3) Anderson, D.R., Sweeney, D.J. and Williams, T.A. (2004) An Introduction to Management Science: Quantitative Approaches to Decision Making South-Western College Pub.
4) Taylor, B.W. (2004) Introduction to Management Science. Prentice Hall.

AECS 41052 RURAL ECONOMICS AND FARM HOUSEHOLD MODELS (2:30/00)

Aim

Aim of this course is to acquaint the students with the agricultural household models and their application to rural economy, explain farm household decision-making under imperfect market conditions, and analyze the influence of development policy on rural welfare and development.

Objectives

- Describe the origins and scope of rural and agricultural development and the household model approaches advocated for promoting it;
- Analyze policies and approaches to achieve rural development;

- Evaluate the institutional framework for rural development and positive change

Course content

Theory

Rural economics and political economy**,** The profit maximization peasants, The risk-averse peasants**,** The drudgery-averse peasants**,** The farm household peasant**,** The share cropping**,** Women in the peasant household, An overview of agricultural household models.

Recommended Readings

1) Frank, E. (1994) Peasant Economics: Farm households and agrarian development. Cambridge University press.
2) Chahdhary, C.M. (2009) Rural Economics. Sublime Publications.
3) Brandt, H. and Uwe Otzen. (2007) Poverty Orientated Agricultural and Rural Development. Routledge.
4) Wright, W. (2008) The Fight Over Food: Producers.Consumers, and Activists Challenge the Global Food System (Rural Studies), Pennsylvania State University Press.

AECS 41062 MARINE RESOURSE ECONOMICS AND BIO ECONOMIC MODELING (2:30/00)

Aim

The aim of this course is to enhance the student's ability to understand economic concepts and models and to assess the irrelevance to marine resource issues and policies. The course familiarizes the students with the concept and application of economics to the different resource based production systems and it also prepares the students to exploit business opportunities in fisheries and aquaculture.

Objectives

- Evaluate the economic impacts of marine management policies.
- Explain the linkages between economics, and environmental science in the marine sector.
- Describe the principles, reasoning, and techniques required to set-up and solve allocation problems, under different social objectives.
- Explain how the policy will serve as both an input and an implicated output.
- Illustrate how the economic tools developed can be applied to renewable marine resources, exhaustible marine resources, water, pollution, and other contemporary problems.
- Interprete the basic principles and tools required to analyze marine resource management problems.
- Explain the importance of proper governance of the fisheries sector.
- Review the status of the fishing community in the country.

Course content

Theory

Introduction to Marine economics, Population dynamics and fishing, A basic bio-economic model, Investment analysis, The Gordon-Schaefer model, Multispecies and ecosystem harvesting, Seafood Marketing and Trade, Non-Market Valuation, Marine and Coastal Recreation, Fisheries Conservation and Management.

Recommended Readings

1) James A. Crutchfield, Arnold Zellner, (2003) The Economics of Marine Resources and Conservation Policy: The Pacific Halibut Case Study with Commentary, University Of Chicago Press.
2) David Whitmarsh, (2011) Economic Management of Marine Living Resources: A Practical Introduction, Routledge.
3) Daniel S. Holland, James N. Sanchirico, Robert J. Johnston, Deepak Joglekar, (2009) Economic Analysis for Ecosystem- Applications to Marine and Coastal Environments RFF Press.

4) F. Maes, (2005)Marine Resource Damage Assessment: Liability and Compensation for Environmental Damage, Springer.
5) Jennifer K. Sesabo, (2007) Marine Resource Conservation and Poverty Reduction Strategies in Tanzania. Springer.

AECS 41072 ECONOMETRICS (2:30/00)

Aim

To give students an introduction to econometrics and in particular regression analysis, this includes an overview of regression techniques and applications to cross-sectional data and time series data as used in microeconomics and macroeconomics, respectively. The course aims to reach a level of econometrics such that applied economic journals can be read with a good understanding and a critical perspective.

Objectives

- Estimate relationships between economic variables
- Test the hypothesis on economic theory using observational data
- Describe the ordinary least squares estimators and discuss their statistical properties
- Test for the presence of multicollinearity and heteroskedasticity in a regression model
- Solve the problem ofmulticollinearity and heteroskedasticity in regression models
- Describe how and when to implement instrumental variables estimation
- Test for the unique problems faced when using time-series rather than cross-sectional data
- Estimate and identify simultaneous equation models.

Course content

Theory

Introduction**,** Nature of Regression Analysis**,** Two Variable Regression Analysis, Two Variable Regression Model, The classical normal linear Regression Model, Two Variable Regression:

Interval Estimation and Hypothesis **t**esting, Extensions of the Two Variable Linear Regression Model, Multiple Regression Analysis**,** Dummy variable Regression Model**,** Multicollinearity**,** Heterscadasticity**,** Autocorrelation**,** Model specification, diagnostic tests. Qualitative response model and simultaneous equations

Recommended Readings

1) Damodar, G.N. (2003) Basic Econometrics. McGraw Hill.
2) Greene, W. H. (2000) Econometric Analysis. Prentice Hall, Engle wood cliffs.
3) Wooldridge, J.M. (2008) Econometrics.
4) Hamilton, J.D. (1994) Time Series Analysis. Princeton University Press.

AECS 41082 PROJECT ANALYSIS (2:30/00)

Aim

Aim of this course is to identify and explain key points in agricultural project planning and demonstrate tools useful for agricultural project planning. It introduces central issues and principles of managing agricultural projects and programmes in the rural developing world, and in particular to demonstrate the perspectives of the contingency school of management and, make participants aware of the skills involved in managing some typical procedures, in particular those of budgeting and procurement.

Objectives

- Describe project planning cycle and issues arising in project identification.
- Explain the basics of monitoring and evaluation.
- Distinguish management approaches used in the projects in rural areas from those used in large businesses or in mainstream public administration.
- Describe the environment in which agricultural development projects are implemented in developing countries and the constraints and challenges that project managers are likely to face in such situations.

Course content

Theory

The basic concepts of project, Aspects of project preparation and analysis, Project cycle, Accuracy of agricultural project analysis, Project costs and benefits, Financial aspects of project analysis, Economic aspects of project analysis, Measures of project worth, Basic microeconomics foundation of cost-benefit analysis, Discounting benefits and costs in future time period, Dealing with uncertainly

Recommended Readings

1) Price Gittinger, J. (1972) Economic Analysis of Agricultural Projects. Economic development institute, USA.
2) Boardman, A.E., Greenberg, D.H.,Vining, A.R. and Weimer, D.L. (2006) Cost-Benefit Analysis: Concepts and Practice. Pearson, Prentice Hall.