General Certification of Education (A/L)
Grade 13

Agricultural Science

Teacher's Instructional Manual

Department of Technical Education
Faculty of Science & Technology
National Institute of Education

General Certificate of Education (A/L)

(Grade 13)

Agricultural Science

Teacher's Instructional Manual

(To be Implemented from 2010)

Department of Technical Education
Faculty of Science & Technology
National institute of Education

Agricultural Science

Teacher's Instructional Manual

Grade 13

First Printing - 2010
ISBN

Department of Technical Education
Faculty of Science & Technology
National Institute of Education
Maharagama.

Printing:

Foreword

The task of introducing the competency based curriculum to the school system reaches completion with the Teacher's Instructional Manual for grade 13.

Due to intense competition to enter the universities, the students in grades 12 and 13 are often under a certain amount of pressure. With the introduction of a new curriculum, the pressure is further increased. An Instructional Manual for teachers of grade 13 in such a context is as important as the syllabus. There are three aspects that a teacher should basically consider here. They are,. the Teacher's Instructional Manual totally matches with the syllabus, the syllabus is based on the vision and mission of the curriculum and the expected competencies of the syllabus, the Instructional Manual has been designed to reach the expected proficiency levels of the students in grades 12 and 13. It is the responsibility of the teachers, therefore, to study the instructional manual intently.

The National Institute of Education is actively involved in training the teachers who handle grade 13 in order to create awareness of the above mentioned aspects. It is, therefore, important that teachers taking part in these training sessions conducted regularly, as these are very useful in understanding the learning teaching principles and procedures given in the Manuals. Teachers are especially expected to use the School Based Assessments to ensure the achievement of competencies. Every body involved in education and evaluation should understand that all these interventions are necessary to enhance the skills of the students without limiting teaching to the subject content only.

I wish to thank all the academics and the other staff of the National Institute of Education and the external resource persons who were involved in the tiring exercise of preparing Teacher's Instructional Manuals.

Dr.Upali M. Sedere

Director General

Preface

This Teacher's Instructional Manual will be useful for teachers who organize the learning teaching process for Grade 13 from 2009.

The Teacher's Instructional Manual is different to the Teacher's Guides we had earlier. Teachers who try to understand the change will notice that this is based on the competency based syllabus. Therefore, it is not expected to reach a given competency within the same grade. It might take longer period of time but the learning out-comes given under competency levels under each competency should be acquired within the same grade. Thus, learning out-comes and competency levels would be immensely useful for you to plan your lessons relevant to the grade. Moreover, we would like to draw your attention that the learning out-comes can be used as a criteria in preparing objectives for the learning–teaching process and preparing evaluation tools to assess the work done. This Teacher's Instructional Manual will be useful to teachers to make the students aware about the reference materials such as extra books and useful web addresses.

Consider that the suggested activities in this book are presented in such away expecting you to act as a creative teacher. A change towards the student-centred education from teacher-centred education is specially expected. Therefore, the teacher should always create learning situations to explore referring different books and internet. When teaching, instead of dictating notes as in the past , new knowledge and principles should be presented in a fascinating manner. For this to happen, communication methods using technology should be used creatively.

Introduce the syllabus to your students who start to learn this subject in grade 13. Students can be motivated by giving the work plan you intend to use for the whole year. This will attract the students to come to school to learn the whole syllabus.

I request you to enliven your creative abilities leading to significant change in your learning-teaching process in the class room which would be a felt experience to the whole country.

I take this opportunity to thank all the resource persons, teachers and the officials of the NIE for their contribution in preparing this Teacher's Instructional Manual. Moreover, my special thanks go to the Director General of NIE Dr. Upali M. Sedara and the Commissioner General of Education Publication and his staff for undertaking to print and distribute the materials to schools. I would be grateful if constructive suggestions are provided.

Wimal Siyambalagoda
Assistant Director General
Faculty of Curriculum Development
National Institute of Education,
Maharagama

Direction:

Dr. Upali M. Sedara	*Director General, NIE*
Mr. Wimal Siyambalagoda	*Assistant Director General, Faculty of Science and Technology, NIE*

Supervision:

Mr. D.M. Keerthirathna	*Director, Department of Technical Education, NIE*

Subject Coordination:

Mr. N.A. Gunawardhana	*Project Leader, Department of Technical Education, NIE*

Curriculum Committe:

Mr. N.A. Gunawardhana	*Chief Project Officer, NIE*
Miss. A.K. Vithanage	*Chief Project Officer, NIE*
Mr. K.G.W.K. Katukurunda	*Project Officer, NIE*
Mr. M.K.D. Deshapriya	*Project Officer, NIE*
Mrs. K.K. Anusha de Silva	*Project Officer, NIE*
Dr. K.L. Wasantha Kumara	*Senior Lecturer, Faculty of Agriculture University of Ruhuna*
Dr. B.V.R. Punyawardena	*Head/Agro Climatology (NRMC), Department of Agriculture, Peradeniya.*
Dr. M.A.J. Wanshapala	*Senior Lecturer, Faculty of Applied Sciences, University of Sri Jayawardhanapura*
Dr. Nilantha de Silva	*Senior Lecturer, Faculty of Agriculture, University of Ruhuna.*
Dr. P.L.A.G. Alvis	*Senior Lecturer, Faculty of Agriculture, University of Ruhuna.*
Mrs. D.A.B.N. Amarasekera	*Senior Lecturer, Faculty of Agriculture, University of Ruhuna.*
Mr. A.L. Sandika	*Senior Lecturer, Faculty of Agriculture, University of Ruhuna.*
Mrs. B.L.D. Balasuriya	*D.D.E. (Agriculture), Technical Education Branch, Ministry of Education.*
Mrs. W.A. Mallika	*D.E. (Agriculture), Technical Education Branch, Ministry of Education.*
Mr. K.M. Chandrasena	*Principal, Animal Husbandry Training Centre Kotadeniyawa.*
Mrs. P.V.S.D. Siriwardhana	*Assistant Director of Education (Agriculture) Zonal Education Office, Gampaha.*
Mrs. Indrani Abewickrama	*Assistant Director of Education (Agriculture) Zonal Education Office, Colombo.*
Mrs. N.G. Ruvini Deepani	*Assistant Director of Education (Agriculture) Zonal Education Office, Kalutara.*

Mr. G.A.A. Silva	*Assistant Director of Education (Agriculture Science) Zonal Education Office, Kalutara.*
Mrs. R.P.R. Subhashini	*I.S.A., (Agriculture) Zonal Education Office, Minuwangoda.*
Mrs. I. Abekoon	*I.S.A. (Agriculture) Zonal Education Office, Gampaha.*
Mrs. G. Chandradasa	*I.S.A. (Agriculture) Zonal Education Office, Homagama.*
Mr. T. Mathiwathanan	*I.S.A. (Agriculture) Zonal Education Office, Piliyandala.*
Mrs. D.S.E. Herath	*Teacher, Joseph Vas V., Wennappuwa.*
Mrs. E.A.C.N. Perera	*Teacher, Vishaka Girls School, Makola.*
Mrs. K.A.M. Kusumakanthi	*Teacher, Sri Medhankara M.M.V., Horana.*
Mrs. P.P.S. Miskitha	*Teacher, Devid de Silva K.V., Minuwangoda.*
Mrs. R.S. Rathnathilaka	*Teacher, Siri Piyarathana M.M.V., Padukka.*
Mrs. K. Vidanagamage	*Teacher, Kalutara Girls School, Kalutara.*
Mrs. H.M.S. Bandara	*Teacher, Vadduwa M.M.V., Vadduwa.*
Mrs. W.M. Nawarathna Menike	*Teacher, Theldeniya National School, Theldeniya.*

Editing:

Dr. L.M. Abeywickrama	*Head, Department of Agricultural Economics University of Ruhuna.*
Dr. B. Ranaweera	*Senior Lecturer, Faculty of Agriculture, University of Wayamba.*
Dr. Anton Perera	*Senior Lecturer, Faculty of Agriculture, University of Ruhuna*
Mrs. K.D.D. Persivel	*Retired Lecturer, Teachers College, Maharagama.*

Translation:

Mr. K.M. Karunaratne	*Retired Planning Executive*
Mrs. R. Sudharma Ratnatilake	*Teacher, WP/HO/Siripiyaratana M.M.V., Padukka,*

Type Setting:

Mrs. Kanthi Ekanayake	*Department of Technical Education, NIE.*

Cover Page:

Mrs. Kanthi Ekanayake	*Department of Technical Education, NIE.*

Introduction

The present Teacher Instruction Manual has been prepared in relation tot he Agriculture Science syllabus to be implemented in Grade 13 from 2010 onwards. It is necessary to face technological changes that take place day to day, especially in the students of an applied and technical subject like Agriculture Science. Along with the advancement of science other new specimens will come to be used very soon in place of the present breads of animals, seed varieties, weedicides and insecticides etc. As such the teacher will have to make use of things used currently in place of examples provided in this Teacher Instruction Manual.

Since, the home garden, crops suited for the home garden and paddy cultivation, have been included, newly, in this syllabus, student should be encouraged to plan a home garden and gain experience of crop cultivation practically.

In the implementation of the instructions provided through this Teacher Instruction Manual, the teacher has to implement an assessment of to ensure that the learning outcome with respect to each competency level is actualized. While the teacher should be prepared in advance to present the material mentioned in the approach to this the material necessary for the student to make his/her presentation should be supplied in the form of quality inputs.

It is your responsibility to improve the practical skills of students by properly organizing the practical exercises provided herein. For the purpose of teaching the subject Agriculture Science a teacher with the qualifications mentioned in the syllabus should be deployed. In instances where a teacher with such qualifications is not available a recommended teacher with a Diploma in Agriculture can be involved for that purpose.

Even where this Teacher Instruction Manual does not carry details of how any particular competency mentioned here is to be actualized, the teacher has the complete liberty to employ a suitable methodology to the learning-teaching process. Similarly, it is my pleasure to inform you that your critical views regarding this publication will prove extremely helpful in the further development of the subject.

Table of Content

Competency 11.0 : Plans to implement pest management practices for successful crop production.

Competency level 11.1 : Makes decisions to implement successful crop cultivation by observing pest and pest population levels.

Duration : 03 periods

Learning outcomes:

- Defines a pest.
- Describes how an organism becomes a pest.
- Describes graphically pest population levels graphically using given data.
- Explains Economic Threshold Level (ETL).
- Describes why pest control is difficult under epidemic conditions.

Teaching-learning process:

Engagement:

- Provide a few plant specimens which are damaged at different levels and True specimens of different pests to the students.
- Lead a discussion focusing on the following points.
  - Awareness of different types of organisms which can damage crops.
  - Those organisms which may damage crops at different levels.
  - Damage levels that depend on the level of pest population.

Proposed instructions for learning:

- Focus your attention on the relevant topic among the following.
  - Factors that effect organism become a pest
- Explain your topic according to the resource book.
- Explain how an organism becomes pest economically .
- Define pest population levels.
- Consult your teacher as and when required.
- Be prepared to present your findings to the whole class.

Guidelines to the explanation of subject matter:

- Lead a discussion to highlight the following.
  That,
  - Any organism which made economical damages to human or human rearing animal (livestock) crop cultivated, or any other assert is refers to as a pest.
  - Different environmental factors will effect the existence of a living population.
  - There is a population balance in the natural environment.
  - Population balance of an organism can be damaged by human activities.
  - As a result an organism, increases in density and becomes a pest.
  - Once the population density of an organism, becomes to the level that it causes economic damage, it is defined sas a pest.
  - The relationship between pest population and time span can be illustrated graphically.
  - The minimum pest population density that can economically damage a crop/ cultivation is called Economic injury level (EIL).
  - The cost incurred to control pest at EIL is virtually equally to the value of the damage caused by the pest.
  - The stage/ level where necessary action has to be taken to prevent pest density rises to EI Level is called Economic Threshold Level.
  - To prevent reaching economic Injury Level, Pest population density should be control below the ETL.
  - It is difficult to control pests at epidemic level.

Competency level 11.2 : Differentiates insect and non insect pests important in agriculture.

Time Duration : 03 periods.

Learning outcomes:

- Lists out the orders of insect pests which damage the crop drastically.
- Describes specific characteristics of insect orders.
- Describes type.
- Lists out non insect pests which can damage crops.
- Describes the types of damage to crops caused by non insect pest.

Teaching-learning process:

Engagement:

- Exhibit a few pest specimens of different orders to the class.
- Conduct a discussion regarding, important characteristics of pest orders, that damages crops and the damage caused by respective pests.
- Focus the attention of students on non insect pests like mites, Rodents and molluscus.
- Lead a discussion to highlight the following points.
    - There are a lot of animal pests that damage crops.
    - Insects are important among them.
    - Identifying pest by classification is important to control pests.

Proposed instructions for learning:

- Focus your attention on the pest group assigned your team from among the following topics.
    - Insects at working location I
    - Insects at working location II
    - Insects at working location III
- Go to the relevant working location.
- Identify the given pests.
- Identify the relevant orders/ groups that they belong to.
- Find out the important features that help identify those orders/ groups.
- Get ready to present your findings to the class.

Instructions on the preparation of working areas:

- Arrange 3 working areas, using the given instruments and materials for the following topics.
  - Insects that belong to Order Lepidoptera, Coleeptera and Diptera.
  - Insects that belong to Order Homoptera Hemiptera, Othoptera, Thisanoptera and Isoptera.
  - Non insect animal pest

Work Station I

- A Hand lense
- A microscope
- Real specimens of insects that belong to Order Lepidoptera, Coleoptera and Diptera.

Work Station II

- A Hand l lense
- A microscope
- Real specimens of insects the belong to Order Homoptera, Hemiptera, Othoptera, Thisanoptera and Isoptera.

Working Station III

- A Hand l lense
- A microscope
- Real specimens of Diagrams of non insect pest such as rodents, molluscus and mites.

Guidelines to the explanation of subject matter:

- Conduct a discussion to highlight the following points.
  That,
  - Insects belong to Phylum Athropoda and class insects.
  - Class insecta is divided into a number of orders.
  - The following insect orders are important in Agriculture
    - Lepidoptera
    - Diptera
    - Coleoptera
    - Homoptera

  - Othoptera
  - Thysanoptera
- Insects that belong to the following orders- Lepidoptera, Dptera, Cleoptera carry complete Metamorphosis.\Insects that belong to order Homoptera, Hemiptera, Othoptera and Thysaneptera show incomplete Metamorphosis.
- Different insect orders inherit specific characteristics.
- Insects that belong to the order Lepidoptera, Coleoptera, Othoptera damage plants by biting & chewing.
- Insects that belong to order Homoptera, Hemiptera, Diptera damage plants by piercing and sucking.
- Insects that belong to order Thysanoptera damage crops by scraping and sucking.
- Different insects attack different crops.
- Mites, moluscus, rodents, bird and other mammals also damage crops.
- Molluscs scrape and eat plant tissues.
- Rodents, birds and other mammals destroy the whole plant.

Competency level 11.3 : Determine possible damage can be made according to the nature of the mouth parts.

Time Duration : 04 periods.

Learning outcomes:

- Identifies and label the typical mouthparts of insects.
- Groups insect by nature of mouthparts.
- Describes damage caused, by insects with biting and chewing mouthparts.
- Lists out insects which damaged crops by piercing & sucking and sucking & rasping.
- Identifies the group of insect pest according to the nature of the damage.

Teaching-learning process:

Engagement:

- Provide real specimens of a few insect or diagrams to the class.
- Provide a few damaged plant specimens to the class.
- Let students observe the damaged specimens and conduct a discussion focusing of the following points.

  That,
  - Different types of insects damage crops.
  - Mouthparts of insects vary from one to another.
  - Nature of damage has a relationship to mouthparts.

Proposed instructions for learning:

- Go to the relevant working area.
- Identify the damage caused by insects of the given specimens.
- Identify the type of mouthpart related to the damage.
- Identify insect in forms as damage to each specimen.
- Be prepared to present your findings to the whole class.

Instructions on the preparation of working areas:

Common inputs for working areas

- Resource book
- Hand lense
- forceps

Location I

- Real specimens of insect pests with biting and chewing mouthparts.
- Damaged plant specimens caused by same.

Location II

- Real specimens of insect pests with sucking mouthparts.
- Damaged plant specimen caused by same.

Guidelines to the explanation of subject matter:

- Insects damage crops in different ways.
  - Both nature of mouthparts and damage are interrelated.
- Typical mouthparts of insects are as follows
  - Mandibles
  - maxillae
  - labrum
  - labium
- Various types of mouthparts can be found as a result of the modification of typical mouthparts.
- Insects with biting and chewing mouthparts, damage crops in a different manner.
  - eaten leaves end up with holes
  - start to eat a leaf from an edge
  - cuts seedlings and buds
- Mouthparts of certain insects are adjusted, to facilitate piercing and sucking.
- Sucking will lead to empty seed and spread of viral diseases.
  - mouthparts of certain insects are adjusted to suit rasping & sucking.
- Insects can be categorised as follows, according to the type of damage they cause.
  - Insects with biting & chewing mouthparts
  - Insects with piercing and sucking mouthparts
  - Insects with rasping and sucking mouthparts
- By observing specimens damaged by the insects above the, nature of damage can be identified.

Competency level 1.4 : Plan appropriate methods to control pest and non insect pests.

Time Duration : 04 periods.

Learning outcomes:

- Describes the importance of pest management.
- Lists out various methods of pest management.
- Expresses advantages of Mechanical pest management practices.
- Compares different pest management methods.
- Describes integrated pest management.

Teaching-learning process:

Engagement:

- Display the pictures which illustrate the damage made by pest as per attachment.
- Conduct a discussion focusing on the following points
  That,
  - Different types of animals attack crops in different ways.
  - These pests can be categorised, as insects and non insects, invertebrates and non insect vertebrates.
  - Various methods can be applied to control them.

Proposed instructions for learning:

- Collect relative information according to the topic assigned to your group
  - Pests that belong to the insect category
  - Pests that belong to non insect invertebrates
  - Non insect vertebrate pests
- Identify and list out pest under your topic
- Explain the suitability of the following methods to control these pest.
  - Physical methods
  - Agronomic practices
  - Biological methods
  - Usage of Pheromones
  - Genetic control methods
  - Legislation methods
  - Chemical methods
  - Integrated pest management
- Highlight examples of the applications above

- Highlight the advantages and disadvantages of the selected methods.
- Be prepared to present your findings to the entire class.

Guidelines to the explanation of subject matter:

- Lead a discussion to highlight following.

  That
  - Animal pest are divided into two categories as insect and non insect pests
  - Non insect pests are again divided into two categories as follows
    - Invertebrates pests
    - Vertebrate pests
  - These pests damage plants in different ways.
  - Various methods can be applied to control pests.
  - Pest control methods can be summarised as follows
    - Physical control
    - Agronomic practices
    - Legislation control
    - Biological control
    - Integrated pest management
    - Pheromone usage
    - Chemical control
    - Genetic control
  - Physical control methods are as follows
    - Hand picking of pest
    - Dragging of brushes, ropes and chains with sticky substances
    - Use of barriers (application of gum)
    - Installation of traps
    - Covering fruits
    - Use of clapping instruments (use clapper boards to chase squirrels, parrots & monkeys)
    - Catch insect using hand scope or hand net
    - Use of light traps
  - Agronomic practices
    - Crop rotation
    - Timely cultivation and harvesting
    - Select most appropriate crops
    - Crop Sanitation
    - Proper soil management

  - Proper water management
  - Proper usage of fertilizer
  - Use of trap crop
  - Cultivation of resistant varieties
  - Mixed cropping
- Under Prevailing legislation, Rules and regulations have been established to avoid immigration of pest and plant diseases that were not there before and to minimize spreading of pest within the country.
- In 1953 United Nations Food and Agriculture Organization (FAO) confirmed this as a act for plant sanitation.
- Quarantine is important.
- Under biological control, the following react as biological control agents.
  - Paracites
  - Predators
  - Pathogens
- Under genetic control practices
  - Release of steriled males
  - Usage of chemical sterile agents
- Pest control can be done using pheromones
  - Pest population density can be monitored
  - Pheromones can be used for mass trapping of pests
  - Pheromones confuse the mating practice of pests (mating disruption)
- Pest control by Hormones.
  - Consider the impact of hormones for physiological activities of pest
  - eg. moulting hormones
    Juvenile hormones
  - Artificial equivalents of hormones are used for the above application.
  - Hormones used to prevent pests from becoming adults
  - Pests become sterile or deformed pupa or die
  - Control pests using chemicals is defined to as chemical pest control
  - When it is necessary, applying a combination of appropriate pest control measures to control pests, is referred to as integrated pest management.
- Application of chemicals is minimized in this process.

Competency level 11.5 : Selects suitable agro chemicals to control insects and non insect pests.

Duration : 06 periods.

Learning outcomes :

- Defines toxicity of pesticides.
- Classifies Insecticides according to their physical characteristics.
- Classifies Insecticides according to the mode of action.
- Classifies Insecticides according to the Active Ingredients (nature of chemicals).
- Lists out chemicals which are used to control non insect pests.

Teaching-learning process:

Engagement :

- Present a poster or a picture which illustrates the application of pesticides, to the class.
- Let students observe the picture.
- Lead a discussion to highlight the following points.
  That,
  - Different types of chemicals are used in pest control.
  - Insecticides can be classified in different ways.
  - Depth of toxicity is described as LD50 value.

Proposed instructions for learning:

- Go to the relevant work station.

  Work station I
  - Classification of pesticides according to the physical characteristics.
  - Classification of pesticides according to the mode of action.

  Work station II
  - Classification of pesticides according to the Active ingredients.
  - Chemicals which are used to control non insect pest.

- Classify pesticides relevant to your topic.
- Explain toxicity, and its relationship of pesticide classification.
- Prepare to present your findings to the whole class.

Instructions on the preparation of work station:

Work station I

- Information source – Pesticides
- Following tables
- Empty pesticides bottles/packets/labels

Table A

Type of pesticides according to mode of action	Example/Trade name

Table B

Type of pesticides according to Physical characteristics	Example/Trade name

Work station II

- Resource book
- Tables
- Empty pesticides bottles / packers/ labels

Table C

Pesticides which are used to control non insects pests	Example/Trade name

Table D

Classification of pesticides base on active Ingredient	Example/Trade name

Guidelines to the explanation of subject matter:

- Conduct a discussion to highlight the following points.
  That
  - Chemicals or natural Substances which are used to control pests are defined as pesticides.
  - Toxicity of a chemical pesticides is describe as LD50.
  - Chemical pesticides can be classified by its own physical properties.
  - Pesticides are available as, Dust, granules, Liquid immelsifiers concentrate, Fumigants.
    (wettable powders, solutions, soluble powder, Bait)
  - Pesticides can be classified according to the mode of action, stomach poisons, contact poisons, Acute poisons, Fumigants and systemic poisons.
  - According to the active ingredients (nature of chemicals) pesticides are classified as, Plant derivatives, Organo Chlorides, Organo phosphate, Carbonate, Synthesized Pyrathroids and third generation compounds. (No organosulpher)
  - Some plant extractors have pesticide activity .
  - Chemicals which are used to control noninsect pests, are described as, acaricides, Rodenticides, miticides, molluscides.

Competency level 11.6 : Selects weeds in cultivated fields with valid reasons.

Duration : 03 periods.

Learning outcomes :

- Defines weeds and provides appropriate examples.
- Identifies and uses weeding practices in a given field.
- Expresses benefits of weeds.
- Expresses environmental adaptations of weeds to ensure its existence.
- Provides examples of alien invasive plants/ weeds.

Teaching-learning process:

Engagement :

- Provide prepared weed specimens to the class for critical observation.
- Let the class classify weedd by observing there nature.
- Lead a discussion to highlight following.
  - The observed plants belong to the weed category.
  - A plant which is outside the main crop of a field is defined as a weed.
- Even under an unfavourable environment a weed exists very successfully.

Proposed instructions for learning:

- Go to the relevant work station.
- Identify given weed specimens.
- List out the adverse impacts of these weed.
- Tabulate the data identified by you as the instructions given in the resource book.

Weed	Highly prominent places	Adaptations for existence	Whether it is invasive or prominent	Benefits

- Be prepare to present your findings to the whole class.

Instructions on the preparation of working areas:

- Provide 10 numbers of either weed specimen or pictures of weeds to each work station.
  - Six specimens of which three each belong to upland and aquatic weeds.
  - Two specimens or photographs of alien invasive weeds.
  - Two specimens, photographs or pictures of rare weeds.

Guidelines to the explanation of subject matter:

- Lead a discussion to highlight the following.
  That,
  - A plant which is outside of the main crop in a cultivated land is defined as a weed plant.
  - Adverse impacts of weeds in a crop field.
    - Decreases crop growth due to the competition for sunlight, space and nutrients.
    - Reduces the quantity of crop yield.
    - Decreases the quality of yield.
    - Increases the costs of pest & disease control.
    - Reduces land value.
    - Reduces effectiveness of farmer.
    - Blocks irrigation channels.
    - Certain weeds have a harmful effect on farm animals and crops.
  - Importance of weeds for human beings
    - Prevents soil erosion
    - Protects soil water from evaporation
    - Feeds farm animals
    - Reacts as a soil cover, it protects soil structure
    - Certain weed are used as medicinal plant.
    - Certain weeds are used as ornamental plants.
    - Legume plants help to increase soil fertility through N_2 fixation (Nidikumba, Thora)
  - Weeds themselves have the capability to adapt for existence.
    - Produce large number of seeds.
    - Ability to overcome unfavourable conditions.
    - Storing of food in different plant parts (under ground stems, Runners, Bulbils, Tubers)
    - Rapid spreading capacity.
    - Certain weeds propagate by both sexual & asexual propagation methods.

- Seeds are adjusted to exist under unfavourable environmental conditions.
- Having efficient seed dispersion methods.
- Common weeds and alien invasive weeds can be found in Sri Lanka.
- Weeds which exist in different areas of Sri Lanka for a long time and have spread in mass are called common weeds.
- These can be divided into two groups called upland weed & aquatic weed

  eg. Upland - Nidikumba, Hulanhala, Wal rubher
  Aquatic - Atora, Bajiri, Welmaruk
- Weeds which have invaded from outside of national boundaries or come from area to area and spread in an invasive manner are called invasive plants.

  eg. Upland - Pathinium, Giant Nidikumba,
  Aquatic - Water hyasinth, Salvenia

Competency level 11.7 : Identify weeds by groups in the fields to determine management practices.

Duration : 04 periods.

Learning outcomes :

- Classifies weeds according to life span and habitat.
- Classifies weeds in the field according to morphological characteristics.
- Describes the importance of the classification of weeds.
- Identifies weeds in the field.
- Uses the knowledge of classification to weed management.

Teaching-learning process:

Engagement :

- Display weed specimens to the class.
- Ask students about the nature of these weed plants, habitat, spreading method and life span.
- Lead a discussion to highlight the following.
  That,
  - Weeds vary from each other according to their own nature.
  - Weeds are classified under certain points.
  - Classification of weeds is important in identification, prevent spreading and helps to control them.

Proposed instructions for learning:

- Sample of weed specimens that belong to different categories are kept in your work station.
- Classify those weeds relevant to the topic given
  Work station I - according to length of life span
  Work station II - according to morphology
  Work station III - according to habitat
- Express the importance of that classification.
- How the classification is put into practice in weed control.
- Apart from the samples given make use of the resource book and your previous knowledge for the findings.
- Prepare to present your findings creatively to the entire class.

Instructions on the preparation of working areas:

- Divide the class into three groups.

  Work station I - Arrange about 15 weed specimens representing annual, biannual and perennial weeds.

  Work station II - Arrange about 15 weed specimens representing upland and aquatic weeds.

  Work station III - Arrange about 15 weed specimens representing broadleaves, Sedges and grasses.

Guidelines to the explanation of subject matter:

- Conduct a discussion to highlight the following.

  That

  - Weeds can be categorized into following groups as
    - according to the length of life cycle
    - according to the morphological features
    - according to the habitat
  - Weeds can be categorize as follows, according to its life span
    - annual weeds
    - biannual weeds
    - perennial weeds
  - According to morphology, weeds can be classified, as follows
    - Board leaves
    - Grass grasses
    - Sedges
  - Weeds can be catagorized according to habitat
    - upland weeds
    - aquatic weeds
  - Weeds which damage the ecosystem and have high spreading capacity, are known as invasive weeds.
  - Most of these invasive weeds are either import for different purposes, or have migrated under different modes.
  - Classification of weeds is important, to select the most effective chemical weedicides.
  - Certain weed groups cannot be controlled by certain weedicides.

Competency level 11.8 : Select appropriate weed control methods.

Duration : 04 periods.

Learning outcomes :

- Lists out different methods used in weed control.
- Describes the application method of each.
- Describes the advantages of biological weed control.
- Describes application of correct cultivation practices use in agricultural weed control.
- Expresses the importance of integrated weed management.

Teaching-learning process:

Engagement :

- Provide visuals of either picture or VCD about weed control, to the class.
- Conduct a discussion to highlight the following points.
  That
  - Control of weeds is required to have a good yield.
  - Various method can be used to control weeds.
  - Mechanical methods
  - Agronomic practices
  - Biological control
  - Legislation methods
  - Chemical methods
  - Integrated weed management

Proposed instructions for learning:

- Pay your attention to the relevant topic among the following weed control methods.
  - Mechanical methods
  - Biological and Agronomic practices
  - Chemical methods & Legislation methods
- Highlight the importance of the control method assigned to your group.
- Explain the application process in this method.
- Explain the suitability of application of same to control weeds in a field.
- Highlight the advantages and disadvantages of the method relevant to your group.
- Present your findings creatively to the entire class.
- Explain how the Integrated weed management application overcome the disadvantages of the above method.

Guidelines to the explanation of subject matter:

- Lead the discussion to highlight the following points.
  That,
  - Weed control methods can be categorised as follows
    - Mechanical methods
    - Agronomic practices
    - Biological methods
    - Legislation methods (statutory methods)
    - Chemical methods
    - Integrated weed management
  - The following practices can be used as mechanical methods:
    - Hand picking
    - Mammoting
    - Removing of aerial parts of plants
    - Burning
    - Mulching
    - Flooding soil
    - Leaving out soil for solar radiation
  - Application of proper cultivation practices to control weeds is referred to as Agronomic practices.
  - The following practices are used as Agronomic practices.
    - Use of very clean planting materials
    - Proper land preparation
    - Proper fertilizer application
    - Mixed cropping soil solarization
    - Inter cropping
    - Animal crop-rotation
    - Cover cropping
    - Maintain correct spacing in crop establishment
  - Use of biological means to control weeds, is referred to as Biological weed control.
  - The Biological control, these is need to follow, the following steps.
  - Selecting appropriate biological agents.
    - Test biological agent under laboratory condition.
    - Carry out field test or live test of biological agent.
    - Observe the actions and injuries of other natural biological agents on the environment.

  - Ensure the host specificity of the biological agent.
  - If the outcomes are satisfactory, introduce the new biological agent
- Three different living organisms are used in biological control
  - Predators
  - Pathogens
  - Paracites
- Examples of the utilization of predators to control weeds
  - Control of cactus – Cactoblastis cactorum
  - Control of Gandapana (Lantana) – Catabena esula
- Examples of control of weeds by using pathogens
  - To control cactus – Cleosporium lanatum (fungi)
- The following factors should be considered beforehand in the application of biological agents
  - These should be specific
  - Ensure that the biological agent is not attacked by any other parasites and predators
  - Should have high potential of reproduction
  - Should not damage other crop cultivations
  - Establishment of rules and regulations to control weeds is defined as legislation method
- The organization which is involved in the control activities related import and export of plants or relevant materials is called the Institute of plant quarantine
- Ensuring the crop won't reach Economic injury level, use non chemical methods, for weed control failing which only chemical methods will be used. This practices is known as the Integrated method.

Competency level 11.9 : Selects appropriate weedicides to control weeds.

Duration : 04 periods.

Learning outcomes :

- Classifies chemical weedicides.
- Tends to select appropriate weedicide correctly.
- Uses correct practices of weed control in crop production.
- Highlights reasons for selectivity of weedicides.
- Lists out examples of weedicides.

Teaching-learning process:

Engagement :

- Use a suitable creative method of engagement related to selection of weedicides for controlling weeds.
- Lead a discussion to highlight the following

  That,
  - Weedicides are react in different ways
  - Weedicides can be categorised in different ways
  - Knowledge of classification of weedicides is useful in chemical weed control.

Proposed instructions for learning:

- Your group may have to study one of the topics listed below.
  - Classification of weedicides according to selectivity.
  - Classification of weedicides according to mode of action.
  - Classification of weedicides according to time of application
- Using resource book collect information related to your topic, according to the instruction given below with regarding to following facts.
  - Factors to be considered in selecting weedicides.
  - Basis of classification of weedicides.
  - The importance of selection of weedicides based on classification.
- Prepare to present your findings to the whole class.

Guidelines to the explanation of subject matter:

- Conduct a discussion to highlight the following points.

  That,

  - Focus attention on the following when selecting a weedicide.
    - Type of weed.
    - Age of weed.
    - Time of application of weedicide.
  - Classification of weedicides according to selectivity
    - Selective weedicides
    - Non selective weedicides
  - Different factors influence in the selection of weedicides.
  - According to the mode of action weedicides can be classified as follows
    - Contact weedicides
    - Systemic weedicides
  - According to the time of application, weedicides can be classified as follows
    - Pre emergency weedicides
    - Post emergency weedicides

Competency level 11.10 : Decides control measures to minimize plant diseases.

Duration : 06 periods.

Learning outcomes :

- Lists out causes of plant disease.
- Identifies infectious and non infectious diseases.
- Decides on the plant disease by examing disease symptoms.
- Lists out diseases caused by biotic factors.
- Describes the mode of spreading of plant diseases.

Teaching-learning process:

Engagement :

- Present true plant specimens effected by disease or photographs, to the class.
- Inquire about the findings of the students regarding the differences between each.
- Lead a discussion to highlight the following points.
  - A deviation from normal physiological activities of a plant is called a plant disease.
  - Disease can be categorised as follows
  - Diseases caused by abiotic factors
    - Physiological diseases/ disorders (diseases)
    - Deficiency diseases
  - Diseases caused by biotic factors
    - Bacterial diseases
    - Fungal diseases
    - Viral diseases
    - Nematode diseases
    - Michoplasmal (phytoplasm) diseases
    - diseases caused by any other Parasitic plants

Proposed instructions for learning:

- Select your topic relevant to your group according to causal agent
  A - Fungi and Bacteria
  B - Virus and nematoda
- Identify the affected sample of specimens among the bulk caused by causal agents assigned to your group.
  - List out examples (disease) affected by above causal agents
  - Explain the mode of spreading of the above diseases.

- Go to relevant work station.
- List out the symptoms of each disease effected by the said above causal agents.

Instructions on the preparation of working areas:

Work station I

- Hand lense
- Microscope
- Plant specimens which are infected by fungi and bacteria and pictures of same.

Special inputs for work station II

- A Hand lense
- Plant specimens which are infected by virus and nematodes and pictures of same.

Guidelines to the explanation of subject matter:

- Lead a discussion to highlight the following points
  - Diseases caused by abiotic factors won't cause infection.
  - Disease caused under physiological disorders and deficiencies fall into this category.
  - Disease caused by micro-organisms are defined as disease caused by bioticfactors.
  - Causal agents of plant disease are as follows
    - Bacteia
    - Fungi
    - Virus
    - Phytoplasma Micoplasma
    - Nematodes
  - The f ollowings are the common symptoms of bacterial diseases
    - Soft rot
    - Leaf spot
    - Vascular wilt
    - die-back
    - forming knots
  - The followings are examples of bacterial diseases
    - Soft rot in carrot
    - Leaf spot in betel
    - Bacterial leaf blight in rice

  - Bacterial wilt in family s olanacea.
- The following are the common symptoms of fungi diseases
  - Mottling
  - rotting of plant tissues
  - dic-back
  - wilting
- There is no chemical or any other substances to control viral diseases.
- Susceptibility to viral diseases can be decreased by improving crop vigour
- Examples of viral diseases, Banana strip virus disease, Bunchi top disease in Banana, Cucumber mosaic virus etc.
- Nematoda have been identified as the more hazardous micro organism.
- While phytoplasma are equal to virus, there is no chemical or any other substance to control it.
- The following are the means of spreading of viral diseases.
  - by soil
  - by air
  - by seeds
- Micro-organisms living in the soil, use to enter plant roots and tubers and cause plant disease. They are called seed borne diseases.
- The following are the symptoms of seed borne diseases.
  - Root rot
  - root knots
  - rooting of tubers
  - wilting of plants
- Examples for soil borne disease are
  - Damping off
  - Bacterial wilt
  - white root disease in rubber
  - root rot
- Micro organism exist in the open air enter use to enter arial parts of plant and create air borned plant diseases.
- Micro organisms enter the plant through physical damages, natural pores, and piercing by plant tissues.

  examples pf the above
  - Blister blight in tea
  - Coffee rust
  - Banana anthraxnose

    - Powdery mildew in the family cucurbitaceae
- Seeds contaminated with micro organisms results in plant disease, such diseases are called seed borne diseases.
- The following are examples of the above
    - Smut in sorgum
    - Soft mottled viral disease in papaw
- Deficiency diseases caused by paracitic flowering plants
    - Total paracitic plants
    - Paratial paracitic plants

Competency level 11.11 : Plans appropriate methods for control of plant disease.

Duration : 05 periods.

Learning outcomes :

- Names the methods that can be applied to control plant disease.
- Describes the importance of controlling plant disease to improve crop yield.
- Presents the different types of application methods of plant disease control.
- States that Integrated plant disease control methods minimise ecological damage.
- Plans appropriate methodologies to protect plant from diseases.

Teaching-learning process:

Engagement :

- Present poster showing of application of plant disease control methods to the class.
- Ask for remedial practices to prevent plant disease.
- Conduct a discussion to highlight the following points.
  That
  - Plant diseases lead to reduction of crop yield.
  - Plant diseases should be controlled in crop cultivation.
  - Different methods can be applied to control plant disease.

Proposed instructions for learning:

- Focus your attention on the topic assigned to your group to learn regarding plant disease control.
  - 1st group - Mechanical methods, Biological methods, Legislation methods
    2nd group - Agronomic practices, Chemical methods, Integrated methods
  - Use the resource book for further information.
  - Describe your topic.
  - Describe the proposed practices for control of plant disease relevant to your topic.
  - Present examples of same.
- Prepare an action plan
  - To Safeguard your school garden from plant diseases.
  - Explain advantages and disadvantages of you proposed system
- Prepare to present your findings to the entire class.

Guidelines for the explanation of subject matter:

- The following are the control methods of plant disease.
  - Mechanical methods
  - Agronomic practices
  - Biological centres
  - Legislation methods
  - Chemical methods
  - Integrated plant disease control methods
- Mechanical control methods used in the is control of plant diseases.
  - Removal of infected plants.
  - Removal of crop debris from the field.
  - Removal of soil or burning of soil.
- Agronomic practices used in plant disease control.
  - Use very healthy planting material
  - Sterilization of seeds
  - Destroy attractive host plants
  - Crop sanitation
  - Crop rotation
  - Apply fertilizer methodically
  - Improve the drainage
- Plant disease can be controlled by application of biological methods.
- Controlling of vectors by means of biological methods help to prevent spread of viral diseases.
- Plant disease can be controlled by cross protection.
- Legislation methods can be used for control of plant diseases.
- Plant disease can be controlled by chemical methods.
  - Fungicides are commonly used in plant disease control.
  - Chemicals can applied to the nursery plant as well as field crops.
  - There are different types of fungicides are ysed ti cibtrik fungal diseases
- There are advantages & disadvantages in chemical method.
- Integrated plant disease management is more important in plant disease control.

Competency level 11.12 : Usage and maintenance of equipment used in pest control in the correct manner.

Duration : 04 periods.

Learning outcomes :

- Identifies and describes pesticide application equipments.
- Describes the requirement of handling equipment in the correct manner for effective pest control
- Describes the importance of sprayer calibration needed to determined the quantity of chemicals that can be added to the tank.
- Insist on the requirement of proper maintenance of equipment.
- Compares performance among knapsack, power and hand operated sprayers.

Teaching-learning process:

Engagement :

- Present pictures and posters which are relevant to spraying to the class.
- Ask students about other equipment used in pest management practices.
- Conduct a discussion to highlight the following points.
  That,
  - Sprayers, dusters and fumigators are used in pest control.
  - There are accepted methods of equipment use.
  - Equipment should be maintained properly.
  - Understand the advantage of proper maintenance of equipments.

Proposed instructions for learning:

- Go to the relevant work station
- Identify the parts of knapsack piston type spraying machine.
- Find out the functions of the respective parts.
- Assemble the machine using the machine parts given.
- Fill the tank with water and test the performance.
- Collect information of calibrating the sprayer.
- Collect information on maintenance of the machine.
- List out the spray machine other than the above.
- Compare the functions of the knapsack power sprayer and hand operated sprayer.
- Prepare to present your findings to the entire class.

Instructions on the preparation of working areas:

- Necessary instruments and materials
  - Resource book
  - A knapsack sprayer which is properly washed or is uncontaminated of pesticide
  - bucket
  - meter ruler
  - floor of sufficient floor area
  - skein of coir rope
  - 1 litre measuring cylinder
  - four pegs

Guidelines to the explanation of subject matter:

- Conduct a revision highlighting following.

  That,
  - The following factors determine the type of machine/equipment suited for pesticide application
    - Type of crop
    - Floor area to be applied
    - Nature of pesticide (liquid, powder, granules)
  - Equipment are categorised according to their functionality
  - Knapsack piston type and power sprayers are the commonly used machines.
  - Knapsack piston type sprayer is a high volume spray machines.
  - Application rate depends on spray pattern of nozzle type.
  - Spray width depends on the type of nozzle.
  - The required volume of solution can be calculated and the required amount of chemicals can be determined by calibration.
  - Knapsack power sprayers are the most suitable spray machines for vast land areas.
  - Handling of equipments and chemicals should be done carefully.
  - Awareness of parts and accessories of equipment.
  - Each and every part should be maintained properly after use (cleaning, washing, drying, applying grease or oil and application of emulsion oil)

Competency level 11.13 : Decides on the most appropriate safety measures in the application of pesticides.

Duration : 04 periods.

Learning outcomes :

- List outs the safety measures to be adopted in the application of pesticides.
- States the awareness information carried on the pesticide label.
- Compares the advantages and disadvantages of application of pesticides.
- Take necessary measures to minimize safety hazards.
- Expresses that the application of pesticides is the last option if other practices are not successful.

Teaching-learning process:

Engagement :

- Present the following dialogue to the class using two volunteers.

1st farmer :	Ranhani Ayya, this time, stem borers & plant hoppers have attacked badly to my field badly.
2nd farmer :	No Ratna malli, at last we'll apply a good chemical pesticide.
1st farmer :	Ranhami ayya, there are different types of pesticides available in the market, we'll select the best pesticide after consulting the Agriculture Instructor.
2nd farmer :	Yes, that is good. Not only in the selection but have to handle it with care. Otherwise stem borers will die at once and we'll die slowly. Anyway I will lend you my tank, lets go to meet the Agricultural Instructor.

- With reference to the above dialogue submit following questions to the class.
  - At what time should chemical pesticide be applied?
  - Why do we need the Agricultural Instructor's advise when applying pesticides?
  - If pesticide aren't handled with care what will happen?
  - With regard to the answers to the above questions, lead a discussion to highlight the following.

That

- Application of pesticides is the last option because they are toxic.
- It is essential to get the advice of a suitable person, when selecting pesticides.
- There are a lot of safety precautions to be taken when handling chemical pesticides.
- Implementation of safety measures, minimization of hazards to the farmer, customer, farm animals and to the environment also.

Proposed instructions for learning:

- Your team has to study one of the following topics.
  - Safety measures on application of pesticides.
  - Information carried on a pesticide label.
- Give brief introduction to your topic.
- Collect information relevant to your topic using the given quality inputs and the resource book.
- State the advantages and disadvantages of chemical pesticide application.
- Prepare to present your findings to the entire class.

Guidelines to the explanation of subject matter:

- Lead a discussion to highlight the following points.
  That,
  - The following instructions have to be followed when selecting and purchasing pesticides.
    - The most suitable pesticide should be selected to control the relevant pest.
    - Purchase only the required amount of pesticide from an authorized dealer.
    - Select only properly sealed and packed containers of pesticides.
  - The following practices aught to be followed when transporting and storing pesticides.
    - Pesticides should not be transported along with food items.
    - Containers/ packages should not carry any signs of damage.
    - Keep away from small children, pets and food items and keep in a secure place.
  - The following practices should be adopted when applying pesticides to the field.
    - Read and strictly follow the instructions given.
    - Select the correct equipment and ensure its fitness for the purpose.
    - Use appropriate measurements to make the required concentration.

- Use safety clothes during application. (protective clothing)
- Taking the closest meal before spraying pesticides and smoking chewing betel and eating should be totally avoided while handling pesticides.
- Apply either in the morning or afternoon on a day when the sky is clear.
- Use the direction perpendicular to the wind.
- When the nozzle is blocked never try to blow it clear with the mouth.
- After application of pesticides the following practices have to be followed.
- Crushed the empty pesticide containers and bury them deep.
- Once spraying is over, clean the equipment with water and pour this water into a empty pit.
- Wash the safety clothes and clean body using soap.
- If a eye is contaminated with pesticide, wash the eye several times using pure water.
- In a toxic situation go to hospital with the label of the pesticide container.

- The following information should be available on the pesticide label.
- Trade name
- Common name
- Declaration as a poison
- Amount of active ingredient, nature and volume
- Price, manufactory date and expenditure should be indicated on the label
- Usage instructions
- Pre-harvest intervals, safety measures recommended of first aids in toxic situations anti toxic substances, should be contained on the label.
- Colour strip with relevant toxic level should be displayed on the label
- The above information should be stated clearly in all three languages (Sinhala, English, Tamil)
- There are advantages and disadvantages in pesticide usage.
  - there are preventive measures to eliminate or minimize such disadvantages
  - pesticides are applied only when there is no other alternative solution
  - application of pesticides is the alternative solution
  - before application of pesticides other control measures should be practiced

Competency 12.0 : Plan to implement post harvesting techniques to get a high quality and quantity harvest.

Competency level 12.1 : Plans home gardens suitable for available land.

Duration : 05 periods.

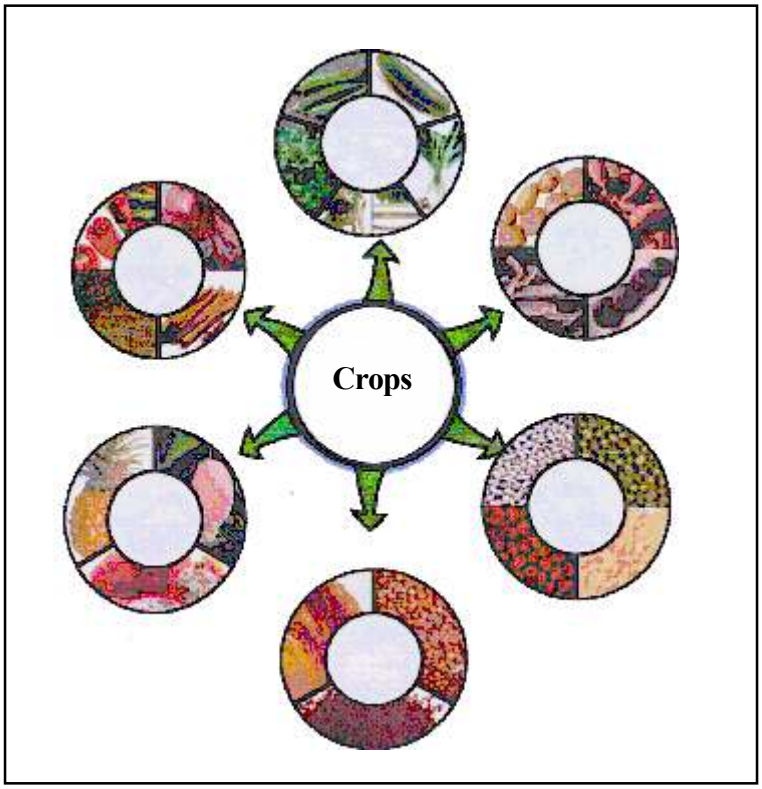
Learning outcomes :

- Categorises the commonly grown crops in Sri Lanka by group.
- States that the nature of yield varies from one to another.
- Plans to cultivate each crop depending on the relevant seasons.
- Describe the different types of crops cultivated in the island and their average yield.
- Presents examples to express that crop harvests are obtained in different seasons.

Teaching-learning process:

Engagement :

- Present the following diagram to the class which consist of different kinds of crops.



- Conduct a discussion highlighting the following points.
  That,
  - Commonly grown crops in Sri Lanka can be grouped as follows.
    - cereal crops
    - pulse crops
    - yams/tuber crops
    - vegetable crops
    - fruit crops
    - spice crops
    - Ornamental crops
    - Oil crops
  - Parts which are obtained as yield can vary within the group, as well as among the groups.

Proposed instructions for learning:

- Focus your attention on the topic assigned to you from the following.
  - Commonly grown cereals, pulses and tuber crops in Sri Lanka.
  - Commonly grown vegetables, fruit crops and spice crops in Sri Lanka.
- Use resource book.
- Discuss the views of your team, regarding the crops in your topic.
- Identify the crops that belong to each category of crop, and the most appropriate environmental factors for each group.
- Give, in brief the parts you take in a yield and the relevant period.
- Prepare to present your findings to the class creatively.

Guidelines to the explanation of subject matter:

- Conduct a discussion highlighting the following points.
  That,
  - The following cereal crops can be cultivated in Sri Lanka under different environmental conditions
    - Rice
    - Kurakkan
    - Maize
    - Sorghum
    - Meneri
    - Thanahal
  - Seed separated from the pod is taken as its harvest.
  - Manage the timing within the season for cultivation.
    green gram, cow pea, black gram, lentils, soya bean, ground nut are the commonly grown pulse crops in Sri Lanka.
  - Crops growing in the area differ from crop to crop.
  - The following are the common tuber crops cultivated in Sri Lanka.
    - Potato
    - Manihot
    - Innala
    - Sweet potato

- Yam

- Tuber crops can be grown in different climatic zones in Sri Lanka.
- The segment where the food is stored in tuber crops is called as Yams.
- A large number of vegetable crops are cultivated in Sri Lanka.

eg. - okra, brinjall, cabbage, bean, carrot, leaks, tomatoes, leafy vegetables

- In vegetable crops, parts are taken as harvest vary.

eg. - nuts, leaves, flowers, pods, whole plant

- Harvesting period varies from crop to crop.
- Sri Lanka, has inherited different crops to suit different Agro climatological zones.
- In fruit crops, fruit is the main yield.
- A large number of fruit crops are grown in Sri Lanka under different climatic conditions in different areas.

eg.
- Mango
- Rambutan
- Avacardo
- Pineapples
- Straw berries
- Wood apple
- Banana
- Water mellon
- Guava
- Mangoosteen
- Belli
- Orange
- Pears
- Dragan fruit

- Fruit crops can be divided as long term and short term according to life span.
- Long term - Mango, Rambutan, Avacardo
- Short term - Pinaple, banana, water mellon
- Certain fruits can be used for cooking

  eg. mango, banana

- The following crops are cultivate as spices
  - chilly
  - pepper
  - red onion
  - large onion
  - cinnamon
  - cloves
  - cardamom
- Yields are different parts of the plant

  eg. chilly - pod cinamon - bark

- Exotic crops which are suited be to cultivated in Sri Lanka also have been introduced.

  eg. dragon fruit, bell pepper

  (Maturity indexes are included competency level 12.3)

Competency level 12.2 : Decides on the stages of post-harvest damage.

Duration : 05 periods.

Learning outcomes :

- Lists out and describes the causes for post harvest damages losses.
- Describes that harvest losses can happen from the point of harvesting the customer's end.
- Describes the stages where post harvest damage can occur.
- Explains the process of post harvesting damage..
- Describes the importance of post harvesting technology.

Teaching-learning process:

Engagement :

- Presents sample of damaged crop yield to the class (tomatoes, vegetables, papaw, cereals)
- Let students identify the damage as suffered.
- Conduct a discussion in relation to these to focus on the following points.
  That,
  - A large extent of crop products go waste daily due to various reasons.
  - The quantity and availability damage occurs from the point of harvesting and to the customer end is defined as post harvest damage.
  - Post harves damage can happen at the following stages
    - Harvesting
    - Cleaning/curing of harvest
    - Transporting
    - Storage
    - Packaging
    - marketing
    - Handling

Proposed instructions for learning:

- Among the probable post harvest damage listed below, focus your attention on the stage/stages assign and to you.
  - harvesting, cleaning, packaging, storage
  - transportation, processing, marketing, handling
- Use the resource book.

- Explore your assigned topic focusing on the following points
  - Explain the importance of post harvest technology
  - Explain the damage incurred at different stages.
  - Describe the nature of the damages incurred with samples of different stages.
  - Explain the relative factors affecting the same.
  - Prepare to present your findings creatively to the whole class.

Guidelines to the explanation of subject matter:

- Conduct a discussion highlighting the following points.
  - Post harvest technology carries a large number of important factors.
    - secure excess harvest
    - secure products in the market
    - control of market price
    - secure excess harvest
    - protect excess harvest obtained from improved varieties
    - to product diversification
    - to retain seeds as planting material for the forthcoming season
    - to minimise waste and improve quality of the yield
  - Yield can be divided into two categories
    - durable crops
    - perishable crops
  - Two types of post harvest damage
    - Qualitative damage
    - quantitative damage
- Factors that effect post harvest damage can be divided into two
  - Physical damage/mechanical damages – Scarification, wound, damage
  - Chemical changes – reduction of taste, colour changes rancidity
- There are three factors that effect post harvest damages.
  - Internal factors - damage due to respiration, transpiration
  - External factors - damage caused by climatic factors, insects and handling methods
  - Pre harvest damage - deficit of water in the field nutrient deficiencies, animal-plant diseases.
- The following factors effect harvest losses.
  - Lack of knowledge of physical maturity status.
  - Incorrect practices and carelessness in harvesting
  - Rough handling

- High packaging cost and non-availability
- Improper storage practices and lack of adequate storage facilities

- Due to weaknesses and mistakes in the harvesting practices mentioned below, leads to post-harvest losses.
  - failure to harvest at correct maturity stage and correct time of the day in correct manner.
  - harvesting in advance or before
    - reduction of weight of vegetables
    - microbical damage
    - fibrousness
    - loss of quality parameters
- Following failures in harvesting practices cause post harvest losses.
  - Rough hand plucking without equipment.
  - Use of unclean equipment
  - Non-maintenance of length of stalk
  - exposure of harvest to sunlight
- As a result of either excess of cleaning or lack of cleaning the following damage can happen.
  - Fungal infections due to contamination of latex on mango and papaw.
  - Cause diseases/ damage as a result of failure to remove unnecessary parts.
  - Scraping/excess cleaning opens the fleshy parts to the air and damage.
- Use of spoilt water for cleaning purposes leads to damage.
- The followings are the causes for damage incurred in packaging.
  - Packing without selecting the crops leads to the spread of diseases.
  - Usage of unsuitable packaging.
  - Over loading in packaging.
  - Pack different types of harvests in same package.
- The followings are the Post harvest damage incurred at storage.
  - storage of crops together which are supposed to be stored neither together nor close by.
  - unclean untidy store
  - wrong stores location
  - high temperature in stores
  - over storage in stores
- The followings are the Post harvest damage that incur at transportation
  - Load of crop beyond the vehicles capacity
  - When loading area doesn't have a cover, crop load open to sun and rain.

- Rough handling in loading and unloading.
- Reckless driving and long transport time.
- Either sitting or sleeping over the harvest.
- Packaging in use not suitable for transportation mode.

- Damage can occur to grains and other crops during the following steps in the curing process.
  - grinding
  - removal of bark
  - polishing
  - removal of unnecessary parts/cutting off
  - usage of unsuitable packing material in packaging
- Damage incurred to harvest in the market can be divided into two categories.
  - Physical damage – damage caused by sunlight/dust/ wind damage and smoke
  - Mechanical damage – rough handling, bad practices at storage
- Damage made by the consumer at handling.
  - Incorrect storage of purchased stuff.
  - Stored in wrong location in transportation (close to the vehicle engine)
  - Rough handling
  - Purchased in excess of consumption without storage facilities
  - Negligence and irregularity at food processing
  - Use for decoration
  - Falsehoods and ignorance
- Post harvesting disease can be caused by fungi and bacteria.

  I passive penetration - penetrate through wound after harvesting the fruit
  eg. brown rotting

  II active penetration - entering
- This pathogens can be inserted in two ways
  - consumption of internal parts of cowpea, bean, dhal seeds by caterpillar of cowpea Weevil
  - red floor weevil - pierce and eat internal parts of rice, ground nut, and cereal crops
  - caterpillar of the rice moth pierce and depend on the cereal grain
- The following pests attack in various ways in stores
  - Rice weevil also damaged to cereals

Competency level 12.3 : Plans to minimize post harvest losses using appropriate techniques.

Duration : 04 periods.

Learning outcomes :

- Describes the importance of control pre and post harvest losses in crop production.
- Explains that, to avoid harvest losses a target number of steps had to be taken, from the point of cultivation until the product reaches the customer.
- Describes, how to minimize harvest losses.
- Explains techniques used to minimize pre-harvest losses to minimize harvest losses.
- Describes the methods used to minimize the post harvest losses for different crops.

Teaching-learning process:

Engagement :

- Provide an opportunity to the students to observe three different maturity stages of a selected crop.
- Ask for views on these three stages.
- Conduct a discussion highlighting following points.
  That,
  - Losses can be minimized by harvesting at the correct time.
  - Wastage of crop harvest, due to various seasons.
  - Harvest damage can be divided into two, based on the stage of occurrence.
    - Pre harvest losses
    - Post harvest losses
  - Proposed instructions for learning.

Proposed instructions for learning:

- Focus your attention on the crop groups assigned to you between the groups listed below.
  - cereal and pulse crops
  - vegetable and fruit crops
- Use the resource book.
- Describe methods that can be applied to minimize pre-harvest losses for the crops assigned to you.
- Propose your action plan to minimize post-harvest losses which occurred from the point of harvest until consumption, of the crop group assigned to you.

- Prepare a handout for a poster or CD under the motto "PREVENT HARVEST LOSSES".

Guidelines to the explanation of subject matter:

- Conduct a discussion highlighting the following points.
  - Since a crop is established in the field until harvesting, the adverse effect of factors which effect crops that will hinder the crop yield is called as pre-harvest losses.
  - To achieve a maximum level of post harvest quality, it is required to identify factors that effect to pre-harvest losses and take necessary measures.
  - Pre-harvest losses can be minimized by following the practices listed below.
    - cultivate during correct season
    - provide shade to control light
    - mulching and irrigation in drought conditions
    - establish crops with proper spacing and pruning
    - cultivate recommended varieties in recommended zones
    - use quality planting materials
    - weed control
    - irrigation and drainage
    - use pesticides and weedicides properly
    - proper fertilizer application
    - thinning of fruits
    - crop sanitation
  - The process of minimizing post harvest losses should start with harvesting itself.
  - Following up on the steps given below will help minimize losses in harvesting.
    - harvest in the most appropriate time of the day relevant to the crop.

      eg.
      - vegetables – after dew is settled in the morning
      - green vegetables – morning
      - plantation – after 3.00 pm, before 10.00 a.m.
  - There are different indicators to identify the maturity stage and to make use of a few indicators for productive harvesting.

    eg. rice
    - 2/3 of the panicle should be mature enough.
    - yellowing of flag leaf
    - yellow coloured stripsin papaw fruit
  - Harvesting losses can be minimized by eliminating mishaps in harvesting practices.

- harvesting by means of machinery
- careful handling of harvest

- Prime expectation of cleaning of harvest is to remove impunities attached to the crop (eg. soil, coarse sand, latex in fruit)
- The following methods can be used to clean the harvest, to minimize the post harvest losses.
  - washing/ hot water treatment (blanching)
  - removal of dead parts such as leaves and roots
  - removal of pests and diseased/ contaminated parts
  - use of pure (clean) water for washing purposes
- The following benefits can be achieved by means of packaging, using correct equipment and applying correct methods.
  - Prevent harvest contact with external factors.
  - Prevent damage incurred in transportation and storage.
  - Prevent removal of volatile compounds.
- Food packaging should have the following features.
  - Non toxics and suited to the food intended to be packed.
  - Resistant to moisture and fat.
  - convenient to re open and stand without brusting.
- The following packaging methods can be used for food packing.

  i. Rigid - glass, metal, wood

  ii. Semi Rigid - Cardboard boxes, Aluminium Container

  iii. Flexible material -
- The following are the different packaging material in use.
  - Poly Ethylene Varieties
  - Glass
  - Alumimium sheets
  - Laminated plastic
  - Paper/ cardboard
  - Tin plated sheets
- The following point should be followed to minimize harvesting losses at storage.
  - Controlling temperature and humidity relevant to the intended stored product.
  - Clear stores and do the required maintenance beforehand when storing yield.
  - ensure safety of stores (protect against rain, humidity, insects and pests)
  - Platforms for stacks
  - Facilitate air circulation among stacks
  - Focus attention on insects and pest control practices in the stores.

  - (use, margoza oil, lemon, Eucalyphtus leaves and NIKA leaves)
- To minimize post harvest losses, the following methods can be applied in transportation.
  - ensure optimum ventilation is available in packaging and transportation
  - Protect from sunlight and rain in transportation
  - Loading and unloading should be handled with safety and in a systematic manner.
  - Smooth driving and quick transportation.
- Select the most suitable processing method which makes less damage and leads to the reduction of post harvest losses.
  - Par-boiling of rice (using Boiler)
- The following methodologies help to minimize Post harvest losses in the market place.
  - Stack yield protecting from sunlight and rain.
  - Provide required level of storage facilities.
  - Systematic packing of vegetables and fruits providing proper ventilation.
- The following are the required practices to minimize post harvesting losses in consumption.
  - Purchase only required quantities.
  - Cook only required quantities, and reduce losses in processing and cooking.
  - Follow protective measures in transportation and storage.
- Prevention of diseases can be done by following the steps listed below.
  - Reducing spores
  - Reducing and prevention of field infections
  - Prevent infection through damage
  - Control diseases and prevent their spreading
- Sanitation also helps prevent diseases.
- Security of harvest can be ensured by preservation methods

Competency 13.0 : Prepare plans by following correct agricultural practices to improve crop production.

Competency level 13.1 : Plan a home garden suitable for available land.

Duration : 05 periods.

Learning outcomes :

- Describes how to plan a home garden according to the land available.
- States that a planned home garden can cater to the nutritional requirements of the family.
- Selects appropriate crops to be established in the home garden.
- Prepares a small home garden through proper land preparation.
- Uses leisure time productively.

Teaching-learning process:

Engagement :

- Present a few posters (picture) of successful home gardens (urban/ rural) to the class.
- Using the above conduct a discussion highlighting the following points.
  That,
  - A home garden is a live environment attached to he home, school, office or workplace which helps to uplift different Social, Physical and Economical activities.
  - Different benefits can be acquired through the productive use of the area around one's home.
  - Productivity can be improved by means of a well planned home garden.

Proposed instructions for learning:

- Do the needful related to the topic assigned to you regarding the home garden systems.
  - Urban agriculture/ farming
  - Traditional farming/ agriculture
- Explain the topic given.
- Describe on your experience, how to plan a successful home garden minimizing problems.
- Plan your home garden against the following topics.
  - Land preparation
  - Preparation of planting material

- Selection of crops
- Establishment and maintenance

- Prepare to present your findings to the class.

Guidelines to the explanation of subject matter:

- Lead a discussion, highlighting following points.
  That,
  - The following benefits can be obtained from a well planned home garden.
    - As per the requirement of the members of the family a balanced diet can be obtained.
    - Contribute to the family economy.
    - Fresh and toxic-free vegetables and fruits can be obtained as and when required.
    - Leisure time of the family can be utilized in a productive manner, and provide an opportunity for Physical exercises.
    - A beautiful home garden generates mental satisfaction and creates a cool and comfortable environment.
    - Minimizes the time and money spent on purchasing.
  - A home garden consists of the following features.
    - Home
    - Fence or Parapet wall
    - Allocated area for cultivation
    - Toilet
    - Well or irrigation system
  - It is necessary to ensure the following requirements are satisfied in the planning of the home garden.
    - generates daily family nutrients
    - earn an additional income
    - product diversification and yield spread over the year
    - ornamental plants and landscaping
    - environmental conservation
  - Based on land usage and cultivation methods, home gardens can be divided into two categories.
    - Urban agriculture - Maximum utilization of limited land, prepare a home garden utilizing modern techniques.
    - Traditional agriculture - Maximum utilization of available land and cultivation of a large number of crops.

- Select crops suitable to the area for the home garden. Select required crops from the crop groups listed below which generate family nutrient requirements.
  - Vegetables
  - Flowers and ornamental plants
  - Spices
  - Tuber crops
  - Cereal crops
  - Pulses
  - Leaf vegetables
  - Medicinal plants
  - Timber plants
  - Fruit crops
- The following methods can be applied in urban agriculture as well as in traditional agriculture.
  - Growing towers
  - hanging bags
  - Soilless culture
  - beds
  - Growing racks
  - Hydrophonic systems
  - Potted plants
- The following undermentioned practices in the establishment and maintenance of crops in the home garden generate a high level of yield.
  - Nurturing in a nursery
    - Nursery made in coconut shells yoghurt cups and milk powder bags etc.
    - Nerido nursery
  - Land preparation
    - removal of weeds
    - Loosening of compacted soil/ crushing or breakdown of large soil clods
    - Plant bed preparation (Raised beds, sunken beds)
    - Watering and Manuring
    - Application of organic fertilizer
    - Chemical fertilizer application (according to growth stages)
  - Pest and disease control
    - Water management, weeding and maintenance plant diversity Following agricultural methods such as crop rotation
    - Application of Margosa oil, Ash and use of repellent crops
- Harvesting should be done at the correct time to obtain maximum benefits from the harvest.
  - Before maturity - Okra, Radish, Carrots, Leafy vegetables
  - After maturity - Fruits, Brinjals, Cucumber
- There are different methods to preserve excess harvest.
- Drying - Bitter gourd, Carrot, Leaks
- Curdling - Milk
- Salting of lime - Lime

Competency level 13.2 : Selects paddy varieties suitable for environmental conditions.

Duration : 04 periods.

Learning outcomes :

- Describes the climatic conditions for paddy cultivation.
- Explains that recommended paddy varieties, should be selected as per the requirement to increase paddy production.
- Describes the variation of production output related to variation.
- Explains cultivation of paddy according to season.
- Describes the sequences involved in self seed paddy production.

Teaching-learning process:

Engagement :

- Present the following conversation to the class using two students.

Dialogue		
Sirisena	-	We have to go without rice because of high prices.
Jayasena	-	Why are prices going up? As we don't have a plan in rice production. Otherwise we would get rice at a lower price.
Sirisena	-	What made you to say so? It is impossible to cater to the demand for rice at this rate of population growth.
Jayasena	-	No don't say that. If we cultivate suitable rice varieties in suitable manner of the right time, we won't experience any rice shortage.

- Submit the following questions to the class.
  - Give one reason for the increase of rice price in Sri Lanka.
  - Present a strategy to increase rice production
- Conduct a discussion highlighting the following points.

  That,
  - Rice is the staple food of Sri Lanka.
  - Rice prices may drop if there is a continuous flow of supply to the market.

- It is necessary to apply the most suitable key practices to increase rice production.

Proposed instructions for learning:

- Select a topic for your team from the following topics.
  - Paddy cultivation in the dry zone.
  - paddy cultivation in the wet zone.
- Using the resource book collect information on the following points, related to the topic assigned to your group.
  - Economical importance of paddy cultivation.
  - Climatic and soil requirement for paddy cultivation.
  - Main paddy cultivation districts.
  - Seasons of cultivation.
  - Recommended varieties for cultivation and special characteristics of these.
  - Self seed paddy production.
- Go to your work station and identify the features of varieties of paddy. Use the table given below.

Name of the variety	Age of the variety	Shape of the seed	Colour (external)	With/without stalk (Nonduwa)	Colour of rice grain

- Get ready to present your findings to the entire class.
- Instructions on arranging the work station.
  - Arrange the work station providing the following.
    - Minimum of ten varieties of rice.
    - A few small knives.
    - A few hand lenses.

Guidelines to the explanation of subject matter:

- Conduct a discussion highlighting following points.
  - Rice is a very important crop in Sri Lanka.
  - Since rice is the staple food it should be cultivated with care.
  - Production and the growing acreage of paddy has increased along with time.

- There are various activities to be followed to increase paddy production.
- Climatic factors such as rainfall, temperature, light and wind affect paddy cultivation.
- A favorable soil condition is essential for successful paddy cultivation.
- Paddy cultivation covers a vast area of Sri Lanka.
- Paddy cultivation is done on a mass scale in the dry zone and low country wet zone.
- There are recommended rice varieties for dry zone and the wet zone.
- The special characteristics of these varieties are that they able to withstand the environmental effects of these areas.
- Paddy cultivation is done under two seasons of yala and maha.
- Field can be increased by the cultivation of correct period of season.
- The timing of paddy cultivation is depends on the lifetime of the paddy variety.
- Self seed paddy production generates an additional benefit.
- There are special steps to be followed in self seed paddy production.

Competency level 13.3 : Plan establishment methods for paddy.

Duration : 04 periods.

Learning outcomes :

- Explains land preparation methods.
- Explains whether transplanting or broadcasting of plants has greater benefits.
- Prepares nursery beds using appropriate techniques.
- Describes the difference between lowland & upland (dry) land preparation.
- Selects the suitable land preparation technique for different climatic zones.

Teaching-learning process:

Engagement :

- Present picture showing land preparation technique to the class.
- Let students explain the activity in the practice of same.
- Conduct a discussion highlighting following points.

  That
  - Proper land preparation prior to establishment is essential for paddy cultivation.
  - There are two key establishment systems such as broadcasting & transplanting.

Proposed instructions for learning:

- Focus your attention on the group of topics assigned to you out of the following.

1st group	**2nd group**
• Lowland land preparation	Dry land preparation
• Lowland nursery bed	Upland nursery
• Nursery plate	Dapog nursery

- Use the resource book.
- Describes the steps in the land preparation technique assigned to you.
- Discusses the advantages and disadvantages of same.
- Describes the method of nursery bed preparation assigned to your group.
- Go to your work station and make a nursery bed using the materials and equipment given to obtain plants for paddy cultivation.
- Explain the establishment methods of paddy.
- One student expresses that broadcasting generate more harvest than transplanting, do you agree with this statement? Explain why?
- Explain the process of recovering abandoned areas. When is this put into practice.
- Prepare to present your findings to the whole class.

Instruction on the preparation of work stations:

- Arrange two workstations to prepare the following type of nursery bed using the given materials and equipment.

First group	**Second group**
Nursery plates	Dapog nursery

Common inputs for all work stations

- Seed paddy

Special inputs for work station I

- A nursery plate consist of 425 cavities in 59cm x 34cm x 2cm
- Muddy soil with clay obtained from a paddy field excluding debris.

Special inputs for work station II

- A few banana leaves or a polythene sheet
- Paddy husk
- A few bricks
- A plant
- Straw

Guidelines to the explanation of subject matter:

- Conduct a discussion to highlight the following
- That cultivation, land preparation is done mainly in two ways.
- That
  - Muddy - land preparation
  - Dry - land preparation
- Mudland preparation undergo two ploughings
- 1st ploughing
- 2n ploughing
- Irrigation requirement is minimal in upland paddy cultivation
- Only seed in sprout (slightly germinated) seeds are used in the nursery.
- The following types of nursery beds are used in paddy cultivation.
  - Muddy nursery
  - Upland nursery
  - Dapog nursery
  - Nursery plates

- The relative methods for each nursery typed has to be followed accordingly.
- Application of these nursery techniques generate successful outcomes.
- Identify the most suitable nursery type based on the requirement.
- The following methods can be applied to the establishment of paddy plants in the field.
    - Direct seeding / Broadcasting
    - Transplanting
    - Broadcasting of plants
- Direct seeding is done according to two different methods.
    - Random seeding/ Broadcasting
    - Row seeding
- Row seeding facilitates weed control utilizing equipment.
- Transplanting can be done in intended spaces.
- Parachute is a modern technique of transplanting (Broadcasting of plants)
- Use nursery plates to obtain plants for sowing (parachute)
- These are advantages and disadvantages of these methods.
- A few days after establishment of a paddy crop in the field replace the isolated areas

.

Competency level 13.4 : Plans appropriate management practices for paddy cultivation.

Duration : 05 periods.

Learning outcomes :

- States that the quality and quantity of the yield can be increased by implementing management practices of paddy cultivation.
- Explains that the most appropriate harvesting techniques applied in correct time leads to increase in quality and quantity of the yield.
- Plans to utilize correct equipment at the right time for harvesting purposes.
- Takes situational decisions on agricultural activities.
- Engages in agricultural activities by minimizing environmental hazards.

Teaching-learning process:

Engagement :

- Present pictures showing different growth stages of the rice plant to the class.
- Lead a discussion to highlight following points using the above pictures.
  That,
  - Rice plant undergoes different growth stages during its lifetime.
    eg. Reproductive stage/ Tillering stage, Maturity stage
  - Different management practices should be applied in each growth stage of the plant.
  - Quality & quantity of crop yield can be improved by following proper management practices.

Proposed instructions for learning:

- Focus your attention on the topic assigned to your group from among the following.
  - Seedling stage and Tillering stage
  - Root primodia initiation stage and maturity stage
- Use the resource book.
- Explain the growth stages assigned to your group.
- Describe the management practices of the crop, related to the growth stage assigned to your group.
- Prepare a hand-bill to educate farmers on how to implement management practices towards minimizing environmental hazards".
- Describe how to determine harvesting stage and harvesting method.
- Prepare to present your findings creatively to the entire class.

Guidelines to the explanation of subject matter:

- Conduct a discussion to highlight the following.

  That,

  - Vegetative stage can be divided into two stages such as the seedling and Tillering stage.
  - Provision of the required environmental conditions will enhance healthy and vigorus seedling plants and good tillering will result.

    eg. - Maintain required water level, light etc.
  - There is a tillering pattern, primary tillers from the mother plant, secondary tillers from the primary tillers and tertiary tillers from the secondary tillers.
  - To reach this growth stage, it takes around 55 days from the point of sawing/ seeding.
  - The percentage to produced panicles against maximum number of tillers is the percentage of fertile tillers.
  - There are different factors that influence for tillering.

    eg. variety, spacing between bushes availability of water for each plant
  - Root primodia initiation take place at the reproductive stage.
  - Heenbandi and Mahabandi stages also fall under the reproductive stage.
  - Flowering start from the top downwards.
  - The duration between embryonic stage of the seed to complete maturity is included in the maturity stage.
    - Milking stage
    - Soldifying stage
  - Different factors that effect seed infertilization.

    eg. low light intensity
    dry wind
    high temperature
    pest attack
    deficiencies
    high rainfall etc.
  - There are four yield components in a rice crop.
  - The yield output can be estimated using the above multiplied by the above measures.
  - Increase of yield components through good management practices in different growth stages help to increase yield output.

- By providing appropriate management practices to the rice plant to suit the relevant growth stages leads to high quality and quantity of harvest.
- Fertilizing, weed management, insect and non insect pest management and disease control belong to management practices.
- Soil testing is preferable prior to the application of fertilizer in paddy cultivation.
- The fertilizer used, is mainly constructed of N, P, K.
- Minimize cost of chemical fertilizers by using straw as manure.
- Transplanting in rows will facilitate weed control.
- Weed control can be done through water management.
- The growth of weeds reduces crop yield.
- Weed control has to be done using proper techniques and in the right time.
- Damage to plants due to insect or any other animal pest can occur at any level of the growth stage.
- The attack at different growth stages are made by different pests.
- should cultivate resistant varieties
- Apply appropriate pest control methods
- Reduction of quality and quantity of the yield depends on pest damage.
- Application of biological pest control systems leads to economical benefits and minimize environmental hazards.
- There is a tendency for diseases to occur at any stage of growth.
- Plant diseases reduces growth and minimizes yield.
- A healthy crop can be ensured through disease resistant varieties.
- Diseases incurred in bandi stage cause greater financial loss.
- Harvesting at the right time using correct techniques leads to increase in quality and quantity of the harvest.

Competency Level 14.0 :

Competency Level 14.1 : Inquires about the job opportunities in the field of animal husbandry.

Duration : 04 periods

Learning outcomes :

- Describes the impotence of animal husbandry in Sri Lanka.
- Presents the potentials of animal husbandry.
- Names the livestock used in animal husbandry.
- Categorises the various products of different farm animals.
- Marks animal husbandry zones on a map of Sri Lanka.

Teaching learning process :

Engagement.

- present the following picture consisting different farm animals.

- Inquire about the importance of rearing above animals.
- Conduct a discussion highlighting following points.

  That,

  - The following animals are reared as farm animals in Sri Lanka.

    eg. Buffaloes, cow
    Poultry, sow,
    Swine
    Goat
  - These animals are spread over different parts of Sri Lanka.
  - Raising of these animals generate various advantages.

- It is important to expand animal husbandry further in Sri Lanka.
- There is a potential for the same.

Proposed Instructions for Learning:

- Focus your attention on the animal products assigned to your group among the following.
  - Meat
  - Milk
  - Eggs
- Identify the animal species which produce relevant animal products assigned to your group.
- Describe the importance of rearing the said animal species.
- Discuss the potentials of rearing these animals in Sri Lanka.
- Mark and display the animal husbandry zones on a map of Sri Lanka.
- Prepare to present your findings to the entire class creatively.

Guideline to explanation of subject matters:

- Conduct a discussion to highlight the following points.
  That,
  - The following animal products are obtained by rearing farm animals in Sri Lanka.
    - Eggs.
    - Meat and relative products
    - Milk and relative products
  - During the past few years a regular increase of animal products and animal population is visible
  - Still these volumes are not sufficient to cater to local requirement
  - Therefore, to fulfill the customer requirement gap the balance volume is imported
  - There is a lot of foreign exchange involved
  - Therefore, it is important to improve and extend further, animal husbandry in Sri Lanka for the same reason.
  - There is a large potential to improve animal husbandry
    Eg. Pasture land
    Excess labour
    Extension services
    Self - employment opportunities

- Base on the distribution pattern of the animal population of Sri Lanka, the following animal husbandry zones have been identified
  - Upcountry
  - Low country wet zone
  - Mid country
  - Coconut triangle
  - Dry zone
  - Jaffna peninsula

Competency Level 14.2 : Plans for animal production output from poultry and cattle by minimizing adverse climatic factors.

Duration : 04 periods

Learning outcomes :

- Names the environment factors that effect Animal Production.
- Discusses the climatic factors that effect Animal Production.
- Describes the adaptations to overcome adverse climatic condition by animals.
- Describes the responses made by animals to adverse climatic factors.
- Discusses the remedial activities to increase animal production by controlling adverse climatic factors.

Teaching learning process:

Engagement:

- Present a picture or a poster to illustrate factors that effect climatic factors, to the class.
- Inquire about climatic factors that effect animal production.
- Conduct a discussion highlighting the following points.
  That,
  - Genetic(genotype) and environmental factors effect physiological activities and productivity of animals like poultry and cattle.
  - Among the environmental factors that effect farm animals the following factors are greater than others.
    - Temperature
    - Light
    - Rainfall
    - Wind
    - Humidity
  - Farm animals are used to adapting and responding to adverse environmental factors.
  - It is important to minimize adverse environmental factors.
  - A high level of production can be obtained through this practice.

Proposed instructions for learning:

- Focus your attention on animal species assigned to you, among the following.
  - Poultry
  - Cattle

- Refer to the resource book.
- Identify the key climatic factors that effect your animal species.
- Discuss the adverse effect of same on animal productions.
- Describes adaptations and responses made by animals to minimize the effect of such climatic factors.
- Discuss the practices that can be applied to minimize adverse climatic factors in animal husbandry.
- Prepare to present your findings to the whole class creatively.

Guidelines to the explanation of subject matter:

- Conduct a discussion to highlight the following.
  That,
  - There is a direct impact of environmental factors on the production of poultry and cattle
  - The following are the adverse effects of these factors
    Cattle
    - Effect of temperature - Reduce the growth and fertility
    - Effect of light - Susceptible to skin diseases
    - Humidity and wind - Increased distribution of pathogens

    Poultry/Fowls
    - Effect of temperature and light - decreasing egg production
    - Effect of Humidity and wind - Increased distribution of pathogens
- Animals respond in different ways to minimize the impact of these adverse climatic factors
  High temperature - Look for cool places/shading, enlargement of blood vessels
  - Intense cold - Reduction of movement/ shivering
- Certain animal breeds have adapted to the changes of the climatic factors
  - Indian breeds inherit a hump
  - Expansion of skin surface area (dewlap)
- Effect of adverse climatic factors lead to the reduction of animal production
- Control of same is important in husbandry
- There are several methods that can be applied for same
  eg. Shading
  Provision of proper nutrition
  Cooling by water
- Acquire a high standard production through practices

Competency Level 14.3 : Plan to upgrade animals towards to increase production.

Duration : 04 periods

Learning outcomes :

- Explains the necessacity of upgrading animals.
- Discusses in brief, the relevant principals regarding upgrading.
- Briefs of supporting factors for selection.
- Analyses breeding methods .
- Discusses the adverse impact of breeding and breeding methods.

Teaching learning process:

Engagement

- Use two volunteers and present the following dialogues in the form of a drama to the class.

A dialogue between two milk farmers

Piyal	:	Is Kamal's new cow giving more milk? You brought a bottle in the past. Now you bring around 12 litres.
Kamal	:	My new cow gave birth. She is a hybrid and can produce around 12 litres of milk. But she can't/ stand in the sun.
Piyal	:	Form where did you buy the cow, Kamal?
Kamal	:	The vet surgeon is the one who located/ her for me. He says that this is a hybrid; our local ones crossed with foreign ones.
Piyal	:	I also would like to buy a hybrid cow. This cow won't give more than three litres of milk a day but they can bear the sun and rain without any problem.
Kamal	:	That's right. Hybrid ones need greater care.

- Inquire from students about the importance of improving animal production in Sri Lanka.

- Conduct a discussion highlighting the following methods.

  That,

  - Environmental factors as well as the genotype influence Livestock production.
  - Animal husbandry in Sri Lanka is still underdeveloped.
  - Animal production can be increased by means of correct breeding method

Proposed instructions for learning:

- Focus your attention on farm animal species assigned to your group, listed below.
  - Cattle
  - Poultry
- Use resource book
- Explain the necessasity of upgrading the animal species, relevant to your topic.
- Discuss the upgrading methods of the same against the following topics.
  - Selection
  - Inbreeding
  - Cross breeding
- Prepare to present your findings to the whole class creatively.

Guidelines to the explanation of subject matter:

- Conduct a discussion highlighting the following points.

  That,

  - Animal husbandry in Sri Lanka is still underdeveloped
  - There are various reasons for same

    eg. insuccessful breeding practices

    bad management practices
  - It is important to eliminate these factors and improve animal husbandry further
  - Upgrading /improving of animals is required for this purpose
  - The following methods can be used for the same
    - Selection
    - Inbreeding.
    - Cross breeding
  - Selection is a method of breeding which is used to improve economically important characteristics of an animal population
  - In selection, animals which and showing genetically advanced characteristics are selected from the population or herd
  - The following supporting factors are used when selecting
    - Production records

- Pedigree records
- Progeny test
- Mass selection.

- There are limiting factors in selection
  eg. application difficulties in small scale farms
- Once suitable parents are selected, allowing them to breed according to breeders requirements is defined as breeding
- The following are the breeding methods
  - Inbreeding.
  - cross breeding
- Breeding between animals that have close relationship is defined as Inbreeding
- Inbreeding can be used to get rid of animal from the population which has inherited diseases and different disorders
- Inbreeding create adverse impacts also
  eg. Reduces fertility
  Reduction of productivity
- Breeding with animals that have genetic variations between two or more breeds is defined a cross breeding
- Objectives of cross breeding
  - Insert favorable genes into an animal population
  - Make use of advantages of hybrid vigour
- Hybrid vigour won't be transmitted from generation to generation
- Alternative cross breeding- Rotational cross breeding leads to the improvement of productivity through hybrid vigour
- Improving characteristics in a population, producing improved breeds and producing new breeds can be done by inserting a favorable gene to the animal population
- Note: Sunandanie and AMZ are the breeds introduced through this process

Competency Level 14.4 : Selects suitable feeds to obtain optimum nutritional levels in farm animals.

Duration : 03 periods

Learning outcomes :

- Inquires about the necessity of a proper nutritional requirements.
- Names nutrients contained in an animal feed to obtain high production.
- Classifies animal feeds.
- Discusses the methods of pasture conservation.
- Selects suitable feeds for different farm animals.

Teaching learning process:

Engagement

- Among the feeds listed below, present the samples located in your area, to the class.
  - Grasses
  - Legumes
  - Silage
  - Cereals
  - Byproducts of cereals
  - Agricultural products
  - poonal
  - fish meal
  - processed animal feed in the market
- Inquire from students the importance of supplying these feeds to animals.
- Conduct a discussion highlighting following points.

  That,
  - Animal nutrition is a key requirement in livestock production.
  - Proper nutrition generates high standards production output.
  - Animals acquire nutritional meals/feeds
  - These feeds can be categorize as follows
    - Roughages
    - Concentrates
  - There are different methods of conserving roughages

Proposed instructions for learning :

- Focus your attention on the farm animals assigned for your group among the following animal species.
  - Cattle and swine
  - Goat and poultry/ fowl

- Identify the most appropriate feed group for the farm animal species assignd to your group.
- Classify further the feed category.
- Describe the importance of the main food components contained in your selection to nourish the relevant animal species assigned to your group.
- Describe the importance of these food components.
- What is meant by animal nutrition?
- Describe the importance of pasture conservation.
- Name pasture conservation methods.
- Document the method of preparation of these feeds.
- Go to your relevant work station.
- Selects feeds relevant to your animal species assigned to your group among the animal feed groups provided.
- Prepare to present your findings to the whole class.

Instruction for the preparation of work stations:

Common inputs for all work stations

- Among the following animal feeds, identify the feeds that can be located in your area and arrange these on a common table.
  1. Grasses - eg. Bracheria spp, Napier spp, Gini grass
  2. Legumes - eg. Gliricidia, Ipil-Ipil, stylosanthus, Siratro
  3. Dry grasses - Hay
  4. Silage
  5. Cereals - eg. Maize, Sorghum
  6. Cereal by-products - eg. Rice brand
  7. By-products of agricultural products-Straw, Molasses, Bagasses
  8. Different kinds of poonal
  9. Fish meal, dried fish powder
  10. Processed animal feed in the market

Guidelines to the explanation of subject matter:

- Conduct a discussion to highlight the following points.

  That,
  - Providing of nutrients according to the body requirements of animal is defined as animal nutrition
  - These nutrients can be grouped as follows
    - H_2O - To maintain body temperature

- Protein - To production and growth
- Carbohydrates- As a energy source (Produce energy)
- Lipid - Energy source
- Minerals - For growth of bones

- Animals acquire the above nutrients from feeds
- Animal feed can be divided into two groups as follows
  - Roughages
  - Counteracts
- More than 18% of crude fiber consist in roughage .
- Roughage is mainly used in ruminant nutrients such as cattle and goat.
- Roughages can be classified further as follows.
  - Succulent roughage
    - Pastire
      - Grass - eg. Bruchiaria species
      - Legumes - eg. Stylosanthes, Siratro
    - Fodder
      - Grass - eg. Gimi spp
      - Legumes - eg. Gliricidia, Ipil-Ipil
    - Silage
  - Dry feed eg. Straw, Hay
  - Others eg. Green Leaves/branches, crop residues
- Concentrates consist of less than 18% crude fiber
- Monogastric animals such as poultry mainly depend on concentrate feeds
- Concentrate feed can be classified as follows
  - Plant based.
    - Fat supplements - eg. Coconut poonac
    - Carbohydrates - eg. Rice bran
    - Protein supplements - eg. Soya poonac
  - Animal based
    - Protein supplement - eg. fish meal
    - Fat- Eg- fish liver oil
  - Vitamin supplements
  - Additives
  - Minerals
- Pasture conservation methods can be divided into two main types
- Dry feed (Straw), Hay production
- Silage production

- Hay is grass which has been dried and stored without allowing the green colour of the grass to be removed totally
- The principle of hay production is to reduce the water content in the grass by drying and inhibit the microorganisms activities and extend the retaining period
- Fermented grass under controlled conditions, which has an average water content is referred to as silage
- Letting carbohydrates in grass convert into volatile Lactic Acids by means of acetic conditions and using the advantage of pH value reduction to inhibit microbial activities and extending the storage period is the basic concept of silage Production
- There are advantages and disadvantages in hay and silage production
- High quality hay and silage can produce under the proper management practices
- Animal production can be increased by providing above feeds.

Competency Level 14.5 : Plans feeding activities considering the structure and functions of the digestive systems of farm animals

Duration : 04 periods

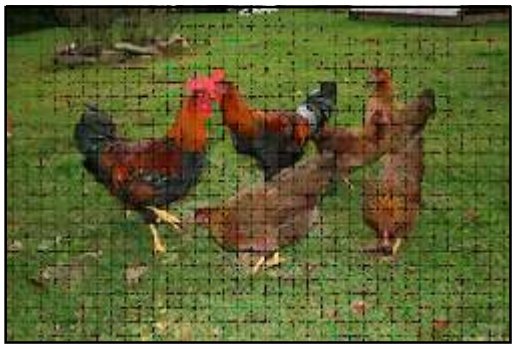
Learning outcomes :

- Classifies farm animals such as ruminants and simple stomach animals. (non ruminants)
- Illustrates the structure of the digestive systems of cattle and poultry/fowl using diagrams.
- Explains the function of the digestive systems in relation to the nutrients fed to animals.
- Describes digestion in cattle and poultry/fowl.
- Compares the digestion system and structure of cattle and poultry (fowl).

Teaching learning process:

Engagement

- Present the following photograph of the feeding system of animals.



- Inquire about the sequences of feed taken by animals.
- Conduct a discussion highlighting the following points.
  That,
- Base on the structure and function of the digestive system, farm animals can be categorize as follows.
  - Ruminants - eg. cattle and goat
  - Simple stomach animals/Mono gastric poultry and swine
- The digestive process can be described as follows.
  - Chemical digestion
  - Microbial digestion
  - Mechanical digestion

- Provide appropriate feeds to farm animals based on the structures and functions of their digestion system.
- Financial advantages can be obtained through same.

Proposed instruction for learning.

- Focus your attention on the animal feed assigned to your group from the animal feed groups listed below.
  - Grasses- Cereals
  - Legumes- Poonac
- Use the resource book.
- Identify the farm animal species that eat food categories assigned to you.
- Illustrate the structure of the digestion system of these farm animals using diagrams.
- Discuss how these animal species digest nutrient component assigned to your by following the digestive processes.
  - Mechanical digestion
  - Microbial digestion
  - Chemical digestion
- Compare the structure and function of the digestive tracks/ systems of fowl/ poultry and cattle.
- Utilizing the given materials, observe and collect informations about the digestive system.
- Prepare to present your findings creatively and collectively to the whole class.

Instruction for the preparation of work stations:

- Arrange two work stations by providing true specimens/ models/ diagrams of digestive system of cattle and poultry.
- Provide the required equipment and materials to observe same.

Guidelines to the explanation of subject matter:

- Conduct a discussion highlighting following points.
  That,
  - Animal feed can be divided into two categories
    - Roughage
    - Concentrates
  - Animals which have a rumen/ complex stomach is referred to as ruminants, and they depend mainly on roughages
  - Farm animal like cattle and goat belong to this category

- They have a complex stomach to digest roughage
- Animals without rumen are referred to as simple stomach animal and mainly depend on concentrates
- Farm animals like poultry and swine belong to this category
- They have a simple stomach
- The digestive system of cattie
- They totally depend on plant feeds, with a complex stomach practice rumination/ regurgitation and digestion process is done by microbes
- The ruminants digestion systems mainly consists of the mouth oesophageous, complex stomach duodenum and small intestine, large intestine
- The complex stomach consists of four parts with special adaptation
  i. Rumen
  ii. Reticlum
  iii. Omesam
  iv. Abomasum
- The mouth is the initial part of the digestive system and the upper and lower jaws are connected in a way to move the lower jaw in wide swings
- The rough and harsh muscular tongue and mucus are used for trapping biting mixing and swallowing of food
- Cattle don't have canines but have highly developed premolars and molars
- There are no incisors on the upper jaw and the area has a thickened gum which helps chewing of fibrous food (dental pad)
- Mature cattle possess up to 32 teeth
- The mouth contains a large number of salivary glands and secrete sufficient saliva for rumination
- Food in the mouth transferred to the pharynx
- From the pharynx food is transferred to the Oesophageous
- The Oesophageous is open to the stomach
- Since the stomach is differentiated into four chambers it is called a complex stomach
- The largest part of the complex stomach is the rumen
- There are a large number of lumps called papillae in the internal wall of the rumen which increase the surface area
- There is no enzymes produced in the rumen in relation to chemical digestion
- The reticulum is the smallest chamber of the complex stomach
- The internal wall of the reticulum consist of a hexagonal structure (bees hive)

- Specially in Infants, between rumen and Reticulum the Oesophageous groove is visible
- In infants the milk is intake directly transferred to abomasums through the Oesophageous groove.
- The internal structure of the omasum is like the pages of a book.
- The abomasums is the glandular walled chamber in complex stomach that secrete enzymes.
- The first part of the small intestine is the duodenum and it receives partially disgested food from the abamasum.
- The internal wall of the small intestine is glandular and has an increased surface area by means of villi
- The large intestine or colon is divided into 2 parts such as the appendix and rectum.
- Absorption of water in food is the main function of the large intestine
- The digestive track ends up in the anus
- The digestion process of cattle can be divided into five, steps as follows
  i. Mechanical digestion or grinding of food
  ii. Mixing with saliva
  iii. Rumination/ Requrgitation
  iv. Digestion by body enzines
  v. Absorption.
- Mechanical digestion of cattle takes place in the vicinity of teeth, rumen reticulum and omasum
- There is no amylase/ tyline in ruminant saliva
- The combination of the regurgitation process of ruminant digestion and microbial digestion (fermentation by microbial enzymes) which takes place in the rumen and reticulum of complex stomach is called rumination
- Cattle spend 8 hours a day on food intake and a similar time on rumination (regurgitation)
- Cellulose, Hemiulluiose and pectin in food are digested by rumen micro organisms
- Glucose is the result of digestion of cellulose which is used by microorganisms for their energy generation, and releases organic acids
- Organic acid is important to form milk fat
- Microbial digestion of protein generates microbial protein
- Microbial protein destructed by pepsin in the abomasums and is converted to amino acid which is absorbed into the body of cattle
- High quality animal protein can be produced by providing non protein nitrogen

- In abomasums, duodenum and small intestine, chemical digestion takes place using body enzymes (approximately 30 %)
- Absorption of digested food takes place in the rumen wall and small intestines

Digestive system of Poultry

- Beak with no teeth
- Tongue used to push feed towards Oesophageous
- There are salivary glands in the mouth
- An expansion of the Oesophageous close to the neck area and is made into a pouch called a "crop".
- The crop is used as temparory food storage
- The Oesophageous opens to the pouch, which is beneath, around 5-7cm from the crop is called the proventicular
- The proventicular secretes HCl & pepsin
- Ellipsoidal shaped pouch made out of muscles is called the glizzard
- The Glizzard is the place where mechanical digestion takes place
- Food in the gizzard is open to the duodenum the initial part of small intestines.
- Pancreatic and bile ducts open into duodenum
- The secreted enzymes from same is used to digest food in the duodenum
- The complete digestion process and absorption of the digested materials takes place in the small intestines
- Micro organisms in the appendix, causes microbial digestion
- Generally it is less than 5 % crude fiber with cellulose consist in poultry diet
- Generally poultry diet consists of less than 5% cellulose
- The large intestine is relatively in wide width and short in length in structure.
- Absorption of water is a function of the large intestine
- The digestive track of poultry ends up with the Cloca
- The Cloca opening is the common chamber of the digestive tract, urinary tract and reproductive tract
- Saliva contains enzyme amylase
- There is no lactase in same
- In proventricular Peptides are formed by digestion of protein
- Pancreatic and bile juices are secreted to the duodenum
- Emulsifying of fat, digestion of carbohydrate peptide and fat is done by same
- Peptides, maltose and sucrose are digested by the intestinal juice secreted by the small intestine

Competency level 14.6 : Select suitable breeds of poultry for different requirements.

Duration : 04 periods.

Learning outcomes:

- Analyzes population and production levels of poultry industry during the past few years.
- Names the basis of classification of poultry /fowl.
- Identifies and documents poultry/fowl breeds by external characteristics.
- List outs suitable breeds of poultry according to requirement.
- Briefs on the organizations and function of those who coordinate the poultry industry in Sri Lanka.

Teaching-learning process:

Engagement :

- Present photographs of different fowl/ poultry breeds.
- Inquires from students about external features.
- Conduct a discussion highlighting the following points.
    - Rearing of poultry for the purpose of obtaining eggs and meat products in Sri Lanka.
    - These fowls/poultry can be classified as follows
        - base on purpose
        - base on origin
    - Poultry farming is distributed in different areas of Sri Lanka.
    - There are different organisations that coordinate poultry farming.

Proposed instructions for learning:

- Focus your attention on the basis of poultry classification assigned to you on the basis listed below.
- according to origin
    - according to purpose
- Refer resource book.
- Classify poultry, using assigned basis.
- Name poultry breeds according to classification.
- Identify features of each breed.

- List out examples of hybrid poultry breeds reared in Sri Lanka for commercial benefits.
  - egg
  - meat
- Identify features of poultry breeds in Sri Lanka.
- Describe the changes graphically in the following areas during the past few years, in Sri Lanka.
  - poultry population
  - distribution
  - production level
- Get ready to present your findings to the whole class.

Guidelines to the explanation of subject matter:

- Conduct a discussion highlighting the following points.
  That,
  - Different Poultry Breeds are reared in Sri Lanka.
  - These breads can be classified as follows.
  - By origin
  - By Purpose
  - Poultry categoried under basis of origin can be further categorised as follows.
    - European Breeds eg. Osterlop
    - American Breeds eg. RIR
    - Asian Breeds eg. Brahma
    - Mediterranean Breeds eg. Leghorn
  - Each of these categories inherit their own characteristics.
    - egg production
    - colour of egg shell and colour of feathers
    - Body weight
  - Poultry Breeds can be identified using these inherited features.
  - At present in Sri Lanka, highbrid Poultry are reared for commercial purposes.
    - For eggs -Production eg. Golden commet, Loman Brown
    - For meat eg. COB, Shaver
  - The poultry industry is distributed in different areas of Sri Lanka.
  - Kurunegala, Puttalam, Colombo, Gampaha and Kalutara are the main areas.
  - There has been a significant improvement of the Poultry Population and Production levels during the past few years in Sri Lanka.

- The poultry Industry has to improve further to meat customer demands.
- There are various organizations related to the Poultry industry in Sri Lanka.
  - Poultry Feed Manufacturers
  - Poultry farms
  - Inputs of Drugs
  - Hatcheries
- The relationship between these organization is essential in the Poultry industry.
- This leads to the improvement of Poultry farm production.

Competency level 14.7 : Plans methods of producing healthy chicks for rearing.

Duration : 04 periods.

Learning outcomes:

- Draws and labels a diagram of the structure of an egg.
- Discusses the production of eggs suitable for incubation,.
- Selects eggs suitable for incubation.
- Inquires about factor to be considered in maintaining a breeding stock.
- Compares and describes Incubation methods.

Teaching-learning process:

Engagement :

- Present the following dialogue to the class using two volunteer students.

Village Hen	:	Gama Hanine kept ten eggs in a basin and gave 21 days time for hatching I heard that she said these are selected ones.
Farm Hen	:	We don't have those burdens, our master has bought a machine to hatch egg which can hatch around ten thousand eggs at a time. However, hatched, we are the ones who have to lay eggs.

- Considering above dialogue forward the following questions to the class.
  - Are all eggs suitable for hatching?
  - What are the hatching/ incubation methods?
- Based on the answers given, conduct a discussion highlighting the following points. That'
  - Hatching is done as follows
    - Natural method
    - Artificial method
- Selection of eggs for hatching has to be done systematically.
- It is important to provide the required conditions for hatching/ incubation.
- Healthy chicks can be obtained through this practice.

Proposed instructions for learning:

- focus your attention on the incubation/hatching method assigned to your group from the systems listed below
  - Natural method
  - Artificial method
- Discuss your method focusing on the following themes
  - Process
  - required conditions
  - advantages and disadvantages
- Discuss the selection of eggs for the relevant process, considering the following themes.
  - Maintenance of a breeding stock.
  - Selection of eggs
- Describe the structure of an egg using a diagram.
- Write down the composition of an egg.
- Go to the work station.
- Select the eggs suitable for incubation/hatching from among the eggs provided.
- Break an egg and study its structure.
- Break the given eggs and identify the organs at different stages of the embrio.
- Prepare to present your findings to the entire class.

Instruction for the preparation of work stations:

- Obtain eggs from a hatchery at different stages of growth or provide relevant diagrams.
- Keep eggs of different sizes and shape on the table.

Special inputs for work station I

- Live eggs at different growth stages
- A few petri dishes

Special inputs for work station II

- eggs of different sizes and shapes
- Balance
- rulers
- Light source
- Petri dish/ a tumbler

Guidelines to the explanation of subject matter:

- Conduct a discussion highlighting the following points
- That,
  - Different parts of an egg can be identified
  - Each part has a delegated function
    - Cuticle - protection from dehydration
    - Air sack - transmission of air
    - Albumin layer - provide nutrition to the embrio
  - Composition of an egg can be expressed as follows
    - according to weight
    - according to chemical composition
  - Chicks can be obtained by hatching.
  - Attention has to be focused on the following points in the production of eggs for hatching.
    - maintain a breeding stock
    - selection of suitable eggs
  - The following factors are important when managing a breeding stock.
    - Selection of breeding animal
    - Provide favourable environment.
    - Male : female ratio
    - Provide nest boxes/egg boxes
    - fertility of breeder's eggs
  - It is important to select suitable eggs for hatching
    - Factors to be considered when selecting eggs for hatching
      - External characteristics
        - cleanliness of the shell
        - shape of egg
        - weight of egg
        - nature of shell
        - colour of egg shell
      - Internal characteristics
        - size of air sack
        - cracks on egg shell
        - abnormalities of egg yellow
        - meat spot and blood spots

- Use light waves to observe internal characteristics
- Hatching of eggs can be done as follows
  - Natural method
  - Artificial method

- In the natural method hatching is done by hens.
- Focus attention on the following in the natural method
  - Select a hatcher/broody hen
  - Arrange a hatching place
  - Introduce eggs to the broody hen
- There are advantages and disadvantages in the natural method
- Incubators are used in the artificial method
- There are two types of incubators
  - Flat type incubators
  - Cabinet type incubators
- Maintenance of incubators is important for a successful hatching process
  - Keep incubator in a level position
  - Fumigate before use
  - control of temperature
  - control of humidity
  - control of ventilation
  - Turning of eggs
- There are advantages and disadvantages in the artificial hatching methods
- Maintenance of the following condition is important in hatching
  - Temperature
  - Humidity
- Non availability of these conditions effects incubation badly

  eg. mutant chicks

  weak chicks
- Chicks hatch after 21 days
- Different growth stages during 21 days can be observed

  eg. on 6th date legs and wings are visible

  on 13th day - colour of the chicks is visible

Competency level 14.8 : Plans for proper management of hen since day one up to the point of laying.

Duration : 03 periods

Learning outcomes :

- Names initial stages in relation to egg production.
- Describes the different methods of brooding of day old chicks.
- Inquires about the conditions required for a brooder.
- Discusses the feeding practices required during growing stage.
- Describes the spacing requirements for chicks and growers.

Teaching-learning process:

Engagement :

- Present photographs of chicks and growers to the class.
- Inquire from students the requirement of these creatures (chicks & growers)
- Conduct a discussion highlighting the following points.

  That
  - It is important to manage the following stages properly for high quality eggs.
    - chick stage
    - grower stage
  - Spacing and feeding requirement vary from stage to stage.
  - Management of the necessary requirements to generate additional profits.

Proposed instructions for learning:

- Focus your attention on the layer breeds assigned to you between the following breeds in Sri Lanka.
  - Hybrid breeds
  - Pure breeds
- Use resource book.
- Discuss the management of relevant stages of birds assigned to your groups according to the following themes
  - methods of brooding
  - feeding
  - other practices
- Discuss the management of layers who belong to the breeds assigned to you according to the themes mentioned below.

- space requirement
- feeding management
- other management practices

- Prepare to present your findings to the whole class.

Guidelines to the explanation of subject matter:

- Conduct a discussion highlighting the following points,
  That,
  - It is important to select high quality chicks for high level of egg production
  - Period from birth up to 8 weeks is called starters
  - Factors to be considered for high standard egg production.
    - active and healthy chicks
    - free from mutants
    - uniform growth
  - average body weight should be 35-40g
  - Until the chick can adjust to the room temperature looking after them by providing feed, water, and temperature is called brooding.
  - Brooding period will be 7 days.
  - There are two brooding methods
  - Natural method
  - Artificial method
  - Chicks after hatching looked after by the brooding hen, is called natural brooding
  - Artificial brooding is done in a brooder
  - In the process of brooding temperature light, ventilation and humidity should be provided under controlled condition
  - Hard board, steel sheets, or plywood can be used to make a brooder
  - To prevent the brooder from becoming dirty lay a litter of 5cm height and lay a paper on it, before introducing birds to the brooder
  - Temperature inside the brooder during the first – seven days should be 35^0C
  - Provide temperature only for 7 days to chicks
  - Required amount of fully loaded water and food containers should be provided in the brooder
  - Remove the brooder after 7 days
  - Once the brooder is removed increase the floor area, provide light during 24 hours through 8 weeks
  - The spacing facility determines the future egg production
  - The space requirement during the said period is as follows (per chick)

1 day – 4 day —> 0.02 – 0.03 m^2

2 week – 6 weed —> 0.09 m^2

after 6th week —> 0.23 m^2

- The Brooder has to be fumigated a week prior to its employment for chicks using Condis ($KMNO_4$/ Potasium permanganate) and formalin mixture
- Immunization programme of chicks is important for a healthy layer stock
- Immunization schedule of chicks is as follow
  - on birth – marex vaccine
  - in 3 weeks – first Raniket vaccine
  - in 6 weeks – fowl fox first vaccine
  - in 7 week - wormicides
  - in 13 week – Second phase of wormicides
  - in 14 week – Raniket vaccine
- Birds of age between 8-18 weeks is referred to as growers
- Management practices during this period effects future egg production because of the rapid growth and activation of the reproductive system
- Between 18-21 weeks, growers start to lay eggs
- Space, requirement of layers depends on the rearing system
- During this stage control of light influences to sexual maturity
- Preparation of feed has to be on line with nutrient requirements of relevant growth stage of the bird
- 0-8 weeks - chicks ration/starters mash (chick mash)
  The bird should be given adequate feed. This is called ad-libitum feeding.
- 8-18 weeks - Ration for growers - limited grower mash and feeding provides the necessary requirements.
- On the first day - Chicks are given boiled cool water mixed with 3 teaspoons of glucose (per bottle)
- If birds are tired, should be given 6 tablets of vitamin B_6 dissolved in water
- In 3-4 day they should be given chick booster or chick mash or Raw rice, feeds should be given on a paper laid down
- After 3-4 days first ration should be given in a feeder
- Nutrient requirements of growers should be, Protein 14-16% fibre 9% Energy - 2700 Kilo calories and fibre content should not exceed 5%.
- For this a growers ration is prepared
- 65-100g grower mash should be given to growers per day
- Changing of feed mixures should not done at once it should be done gradually within 3 days

- Culling is important in each growth stage for high egg production (removal of unwanted birds)
- Debeaking should be done to prevent canabalism, wastage of feed, drinking of egg
- De beaking should be done at 6-9 day or 10-14 week or 18 weeks
- 2/3 of the upper beak and 1/3 of the lower beak should be cut with a sharp pair of scissors and should be burnt
- The equipment called the debeaker which functions on electricity can be used for debeaking
- Disease control also important in these stages

Competency level 14.9 : Plans proper management practices for layers.

Duration : 04 periods.

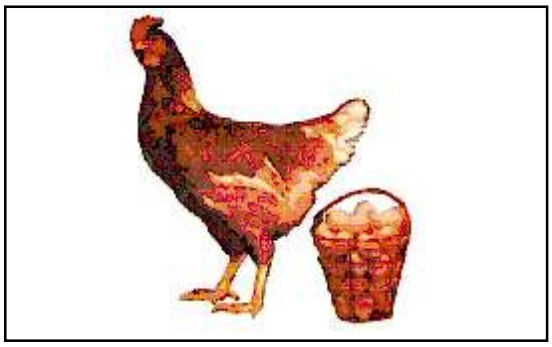
Learning outcomes :

- Describes that egg production of a hen is varies according to breed.
- Shows the relationship between poultry/fowl nutrition and egg production.
- Highlights the necessacity of preparing layer cages in a poultry house.
- Documents the required spacing for hen in a poultry house.

Teaching-learning process:

Engagement :

- Display a photograph of a hen (layer) with eggs, to the class.



- Using it, inquire from the students about factors affecting egg production.
- Conduct a discussion highlighting following points

  That,

  - The following factors are important to ensure high standard egg production
    - Nutrition
    - environmental factors
    - adequate space requirements
    - egg boxes/ nest boxes
    - control of diseases
    - Culling of (removal of) unwanted hens
    - debeaking

Proposed instructions for learning:

- Focus your attention on the breed assigned to you, from among the breeds listed below which are mainly raring of layers
  - Light breeds
  - Heavy breeds
- To have a high standard production from the layers assigned to you, discuss the management activities involved against the themes listed below
  - providing feed
  - management of environmental factors
  - clean egg production
  - other management practices
- Present your findings to the entire class.

Guidelines to the explanation of subject matter:

- Growers which are age between 20-22 weeks of age are refered to as layers
- Eggs vary according to breed
- Layers which give a high yield can be identified by their body characteristics
- The following factors are important in selecting layer that generate an economical egg harvest
  - long life time
  - medium body build up
  - high feed conversion efficiency
  - vat impell for hatching/brooding
  - capacity to withstand minimal environmental factors
  - laying eggs in a short tim
  - high reproduction efficiency
  - high quality of eggs
- There are three environmental factors to be focused on in the management of layers
  - light
  - temperature
  - environmental humidity
- Control of light supply is one important factor regarding layers management
- Longer day time results in the early sexual maturity of pullets
- Shorter, day time delay the sexual maturity of pullets
- Completion of re-production system, and physical growth with sexual maturity is a feature of a high quality layer hens
- There is a standard method of controling light for layers

- Provide light on 20th week —> light 12 hrs
  on 22nd week —> light 13 hrs
  later on increase the light duration by half an hour for each fortnight until it ends up with 17 hrs
- The following are the advantages of light control
  i. Increase production time by delaying sexual maturity and obtain high egg yield
  ii. birds become tame
  iii. Avoid adverse production factors such as cannibalism, moulting
- Matured birds and birds close to maturity can exist, without an adverse impact on their Biological Progress in an environment of 22-24^{0}C Temperature
- That temperature range is called comfortable temperature zone
- The environment temperature variation to comfortable temperature zone influences egg yield
- The following activities help minimize impact of temperature
  i. use of properly designed poultry houses
  ii. point plan houses facing the direct sun light
  iii. use plants for shading
- Humidity has an impact on egg yield and 70% humidity is ideal for optimum egg yield
- At the end of age range of 18-21 weeks (growth stage) transfer birds to the laying pen
- There are several matters to be considered on transmission of birds to laying pens
- Once 5% of the stock start to lay eggs egg cages should be fixed
- Clean eggs can be obtained by providing egg cages
- Factors to be considered in fixing of egg cages can be compiled as follows
  i. length 45 cm x bredth 30cm x height 145cm and entrance hole should be 20x20 cm
  ii. 5cm layer of paddy husk or saw dust use as litter
  iii. facility of easy cleaning
- A hen belongs to the Leghorn breed requires a floor area of 0.16 m^2
- 10 cm lengths required for a layer for feeders
- 2.5cm - 1.5cm space is required for waterers
- layer mash required for layers should be started as feed at the age of 20 wks

- Conversion of feeds has to be done gradually from grower mash to layer mash as follows

	grower stage	layer stage
1st wk	75%	25%
next 2 wks	50%	50%
next 2 wks	25%	75%
0	-	100%

- Nutritional composition of layer mash is as follows

  Protein - 14% - 16%

  Fibre - 7-9%

  Energy - 2800 k.c. (kilo calaries)

- At the initial stage of laying start with 0 gram of feed per day and towards the end increase the quantity to 125 gram per day for a hen.
- Eggs laid in initial stage are small and these called as pullet.
- Egg production increases rapidly between wk 20- to 28 and reaches the maximum level between 28-32 wks.
- When the laying stage (16-18 weeks) is reached it is necessary to provide additional feed that consist of Calcium
- Out of the total volume of mineral in the egg shell, calcium carbonate contribute 98% of the same
- It is important to feed around 5-10 grams of calcium per day to a hen

Competency level 14.10 : Select suitable birds for profitable poultry/fowl farming.

Duration : 03 periods.

Learning outcomes :

- Describes the importance of culling of unwanted birds from the flock.
- Describes the stages of culling.
- Describes the factors that influence for culling.
- Identifies the features of the eggs which are not suitable for hatching.
- Compares the features of birds which have a high production ability with these with low production ability.

Teaching-learning process:

Engagement :

- Present the following points using two volunteers

Dialogue

Farmer	**:**	Sir though I feed enough to my poultry they are giving me few eggs, my profits also have gone down.
Agriculture Officer	**:**	That's true. What you have got to do is remove the ones who do not give eggs and are giving a small number of eggs. Then you can retain the good layers and save the cost of feeds and increase profits.
Farmer	**:**	I don't know how to select them because all are fed well and look healthy and have no diseases to talk about.
Agriculture Officer	**:**	It is not important from the day one looking at the certain features you can decide whether it is a good one or bad one. I'll drop in shortly and teach you how to identify the good ones.

- By Refering to the dialogue, inquire from students, the action that can be taken to improve profit in the poultry, run.

- Conduct a discussion highlighting the following points.
  - In a fowl flock there are high standard producers and low standard producers.
  - Weak producers can be identified by means of their features.
  - These need to be culled.
  - Profits can be increased by this.

Guidelines to the explanation of subject matter:

- Focus your attention on the culling stage assigned to you, among the stages of the same listed below.
  - Eggs stage and prior to introduction to the brooders.
  - At the point of removal from the Brooder and growing stage.
  - Initial stage of laying and laying stage
- Use the resource book.
- Describe the importance of the culling stage assigned to you.
- Identify the features related to culling at the stage assigned to you.
- Describe the advantage of culling at the stage assigned to you.
- Prepare to present you findings to the entire class.

Instruction for the preparation of work stations:

- Conduct a discussion highlighting the following points.
  - Removal of unwanted, low productive birds from the poultry flock is called culling.
    - culling is done at the following stages,
    - at the stage of an egg
    - prior to introduction to the Brooder.
    - at the point of removal from Brooder.
    - growing stage
    - initial stage of laying
    - laying stage
  - To maintain a high standard of quality eggs, culling is done at eggs stage.
  - Culling of eggs is done base on two factors
    - External features
      - egg is not of oval shape
      - dirt contamination /uncleanliness
      - less than standard weight
    - Internal factors
      - blood spots

  - liquid nature of the inside of the egg
  - showing symptoms of disease
- The following features are taken into account when culling at growing stage,
  - lack fully grown feathers
  - display disease symptoms
  - reduction in growth
  - display of abnormal features
  - wounds
  - reduction in activeness
- Factors to be considered when culling unwanted birds close at laying stage.
  - birds with slow growth, unbrightnes and droopy feathers
  - birds with pale and sunken eyes
  - birds with small scaly and shriveled comb
  - birds that are weak and display disease symptoms
  - birds that do no show proper growth
  - birds with deformed keel bone
  - birds which have a head like craw
- Factors to be considered when culling unwanted birds at laying stage.
  - birds with pointed head and sunken eyes
  - shrunken, dried comb
  - birds with a short/distance between keel bone and pinbone
  - birds which have beak, nail, feathers in good order
  - de pigmented birds
  - birds which display uneasiness
  - early moulting and delay in growth
  - birds which had brooding characteristic
- Removal of unwanted birds results in several advantages
  - low outlay on feed
  - provision of required facilities possible for birds
  - prevents spread of diseases
- Culling of birds systematically help increase profit.

Competency level 14.11 : Plan housing of poultry according to rearing systems.

Duration : 05 periods.

Learning outcomes :

- Describes rearing systems of poultry/fowl.
- Describes the importance of providing a house for poultry/fowl.
- Provides a house poultry/fowl.
- Describes how housing of poultry varies according to the rearing system.
- Describes the conditions in the House of Poultry.
- Selects a rearing system suitable to the area and housing of poultry.

Teaching-learning process:

Engagement :

- Present the following dialogue using two students.

Dialogue

Nephew : Are you busy uncle?

Uncle : Yes, I am putting feed for my poultry.

Nephew : I also have thought of starting a poultry farm.

Uncle : That's good. But you have to do it properly. You have to select a suitable rearing system, according to the space available and have to have a poultry house with security and sufficient space. Facilities are needed for feeding, drinking water and laying also should be provided. Then birds will grow well. You just drop in the afternoon and we will discuss it further.

Nephew : OK uncle.

- With reference the above dialogue inquire from students the importance of a house of poultry.

- Conduct a discussion highlighting following points.
  That,
  - There are various rearing systems for poultry.
  - Housing of poultry varies with the rearing system.
  - Provision of houses for poultry generates various advantages.
  - Secures them from adverse environmental conditions.
  - Secures them from disease and external threats.
- It is important to provide the required conditions for poultry inside the house of poultry.
  - Sufficient space, feed, water.
- Possible to obtain high productive through this practices.

Proposed instructions for learning:

- Between the stages of poultry listed below focus your attention on the stage assigned to you.
  - growing stage
  - sexual maturity stage
- Explain comparativly rearing systems of poultry relevant to the topic assigned to you.
- Describe the importance of housing for poultry in rearing of same at assigned stage.
- Identify type of housing according to the rearing system.
- Identify the main housing type of poultry used in Sri Lanka in rearing poultry.
- Discuss the factors to be considered in the arrangement of Housing of poultry for the group assigned to you through the aspects listed below
  - space requirements
  - equipment
  - management of deep litter
- Prepare to present your findings to the entire class.

Guidelines to the explanation of subject matter:

- Conduct a discussion highlighting following points.
- That,
- The following are the rearing systems of poultry in Sri Lanka
  - Free range system
  - Semi intensive system
  - Intensive system

- The system which allows birds to move and eat freely in the day time and providing a shelter for the night is called the free range system
- Using this system around 350-450 birds can be reared in a Hectare
- Since it requires more space it is more suitable for rural areas
- Various types of poultry houses in free range system
  - Hanging types
  - Slatted floor
- Provide 1000 cm^2 per hen in the poultry house
- Since the lie only in the night time keeping of waterous or feederon in the house of poultry is not essential.
- There are advantages and disadvantages in this method
  - Advantages - No cost involved in feeds
  - Disadvantages - low production
- Provide run, covered with wire mesh to move in the day time, and provide shelters/ pens for the night is called Semi Intensive System
- Under Semi Intensive System, 700-900 birds can be reared per one hectare
- This system is more suitable for semi urban areas
- There are two main types of poultry houses
- permanent/ fixed houses
- movable house
- Provide 1500 cm^2 in a house for a bird
- Feederes and waterers are also provided in the house
- There are advantages and disadvantages in this system
  - Advantages – easy to collect eggs
  - Disadvantages - management difficulties rearing on mass scale
- Birds confined to the house entirely with all requirements is referred to as Intensive System
- In this method stocking rate is 2500-3750 birds per hectare
- This is usually adopted to urban areas where land is limited and expensive
- An adequate amount of waterous feedarous and egg cages should be provided in to the house
- There are advantages and disadvantages in this method
  - advantages - high production
  - disadvantages - cost of feed is high
- There are three main types that can be identified under the intensive system
  - Deep litter system – keep the animal in a house/shelter with a litter

- Slatted floor systems – keep the animal in a house which made of wooden strips, bamboo strips or mesh
- Cage system
  - Single cage system
  - made of wooden strips or net (mesh)
- colony cage system/multiple cage system
  - birds are reared in a slatted house

- Among them the deep litter system is the most common and is a popular in poultry keeping method in Sri Lanka
- paddy husk, pieces of straw, saw dust can be used as litter
  They are
  - lightness
  - profitability
  - non toxic to the animal
- When keeping animals in a litter it should be maintained properly
- raking
- if it is wet, apply calcium, hydroexide
- litter should be replaced when it is old
- Following requirements should be supplied to the animals in the deep litter the system
  - Space
    - according to the growth stages the following spacing should be provided
      - age 1-2 week – 0.03 m^2
      - age 2-6 week – 0.09 m^2
      - age after 6 week – 0.2 m^2
  - Feeders
    - Different shaped feeders can be used to feed animals
      - oblong shaped feeder
      - round shaped feeder
      - auto shaped feeder
    - According to the growth stages, space requirement of feeders vary
      - for growing hens
        - oblong feeders – 6.4 cm per bird
        - round shaped feeders – 3.8 per bird
      - for laying hen
        - oblong feeder – 10cm/bird
        - round shaped feeder – 4.9cm/bird

- Waterers/drinklers
  - The following type of waterers are used to provide water to poultry
    - General type of waterer
      - oblong
      - round
    - Auto type drinklers
  - Waterer should have volume related to the growth stage
    - growing stage
      - oblong waterers – 1.9 cm per bird
      - round waterers – 1.3 cm/bird
    - Layers
      - oblong waterers – 2.5 cm/bird
      - round waterers – 1.5cm/bird
- It is important to arrange nest cages/ nest boxes in the poultry houses of layers
- Clean eggs can be obtained through this practice
- It is important to fix roosts/ roosting poles in the poultry house for them to stand at night.

Competency level 14.12 : Display readiness to rear broilers.

Duration : 04 periods.

Learning outcomes :

- Describes the important factors to be considered when rearing broilers.
- Names the components, of broilersrations.
- Describes the process of meat production using broilers.
- Names the form of broiler meat supplied to the market.

Teaching-learning process:

Engagement :

- Present the following photograph to the class consisting of meat chicken.

- Conduct a discussion highlighting the following points with reference to the above picture.
  - Broiler is a hybrid poultry reared for meat production, that reach as the market within a short period of 42 days.
  - There are various factor that affect there rearing of broilers.
  - Preparation of meat for marketing should be done systematically.
  - This practice generates greater income.

Proposed instructions for learning:

- From the Broiler types listed below, focus your attention on the type, assigned to you.
  - Vencob
  - Indian River

- Describe important management practices of rearing the broiler type assigned to you, on the following points.
  - Space Requirements
  - Nutrition
  - Watering and feeding
  - Lighting
  - Vaccination
- Describe the process of preparing broiler chicken for the market.
- Prepare to present your findings to the whole class.

Guidelines to the explanation of subject matter:

- Conduct a discussion highlighting the following points.
  - There are various broiler breeds reared in Sri Lanka
    eg. Indian river, Vencob
  - Broiler management generates profits within a short period
  - The following factors influence maximum profit
    - Space
    - Nutrition
    - Other management practices
      - lighting
      - Vaccination
  - Provision of sufficient space is important in rearing broilers
  - Insufficient space create various problems.
    eg. cannibalism
  - Reduction of production due to same because weakness of the bird
  - If the space is more than the requirement it will increase the movement of birds and reduce the feed conversion ratio
  - This reduces production
  - It is important to provide high level of nutrition to the broiler since they show a rapid growth rate
  - For this purpose, either rations available in the market or self produced rations can be fed as disirable
  - Rations vary with the age group
    - Day 0 - 4 wks - starter rations
    - After 4 wks - Finisher rations
  - Accordingly watering and feeding should be done systematically
  - Various types of containers that suit various age groups are used for the purpose

- Provision of light for over 24 hours/ day stimulates feed intake of broilers
- Bulbs or florescent bulbs can be use for this purpose
- Vaccinate broilers to prevent incidence of diseases like Gamboro and Raniket
- Vaccination can be done by means of adding vaccine material to drinking water or as eye drops
- In processing Broilers for meat a few steps need to be followed
    - Keep without feed
        - 8-24 hours prior to killing
            - wastage of food and uncleanliness can be minimized
            - Facilitate processing
            - Reduce cost of feed
            - Minimize secondary infection
- Catch the bird by legs (in the night or in the morning)
- Transportation of living birds (in the night or in the morning)
    - Plastic or steel mesh boxes can be used for this purpose
    - It is important to ensure that birds are not distressed while transporting
    - Quality standard of the dead carcass can be improved by this practice
- Stunting and cutting neck
    - Hang birds firmly using either leg fetters or frames
    - Stunning of birds by means of electric equipment, CO_2 or by sinking head into a water container
    - It is important to allow, blood to drain as much as possible while the bird is on the leg fetters
    - Quality standard of the dead carcass can be improved by this practices
- Scalding
    - Sink the carcass in hot water at 51-29 C over a period of 30-120 seconds
- De-feathering
    - feathers are removed by burning
- Removal of mesenteries
    - Use a cut at cloca and remove mesentery
    - Separate edible part out of it (giblets)
- Freezing
    - Sink mesentery removed carcass in water at 2.2 C for over a period of 15 minutes and hang until excess water is drained
    - Parts required for specialize food items have a higher demand
    - Transport polythene is used for packing

- Storage
  - If the product is intend for sale on the same day, it can be stored in a refrigerator
  - Otherwise use a deep-freezer
- High standard broiler chicken has a great demand

Competency level 14.13 : Select appropriate cattle breeds suited for various requirements.

Duration : 04 periods.

Learning outcomes :

- Identifies problems and potentials in cattle management.
- Classifies cattle based on origin and purpose.
- Identifies cattle breeds according to external characteristics.
- Names the cattle rearing zones in Sri Lanka.
- Analyzes cattle population and production volumes during few years.

Teaching-learning process:

Engagement :

- Present the following photograph consisting various cattle breeds.

- Inquire from students regarding the different external features of cattle.
- Conduct a discussion highlighting the following points.

  That,

  - Different parts of Sri Lanka rear different breeds of cattle.
  - Cattle can categorize as follows
    - Based on Origin
    - Based on Purpose
  - At present their is a considerable improvement visible in the cattle population milk and meat production.
  - There is a potential for further improvement of the cattle industry in Sri Lanka.

- Therefore it is important to enhance the cattle industry by eliminating existing problems.

Proposed instructions for learning:

- Focus your attention on the products assigned to you from among the products listed below
  - Curd
  - Cattle manure
- Name the animal group which supply the product assigned to you.
- Identify the various breeds that belong to the said animal group.
  - Classify these breeds
    - by origin
    - by purpose
- Among these animal breeds, identify the breeds suitable to be reared according to he following animal management zoones
  - Dry zone
  - up-country wet zone
  - Mid country - wet zone
  - Coconut triangle
  - Jaffna Peninsula
- During the past few years
  - Cattle population
  - Distribution
  - Milk production
  - Meat production
- Present the changes above, graphically
- Discuss the problems and potential in the cattle industry in Sri Lanka.
- Prepare to present your findings to the whole class

Guidelines to the explanation of subject matter:

- Conduct a discussion highlighting the following points.
  - Cattle and buffalo are reared in Sri Lanka for the purpose of obtaining milk related food and cattle manure.
  - Cattle breads such as Fression, Jersey, Sahiwal and Sindi are reared in Sri Lanka
    - Europian breeds - Freession, Ayrshire
    - Indian breeds - Red sindi, Sahiwal
    - Native breeds - local bteeds (Batu)

- There are differences between Europian and Indian breeds
  eg. - Milk Production
- Based on the purpose, cattle can be categorized as follows
  - For milk production - Fression
  - For meat production - Beef master
  - Dual purpose
- There is no systematic cattle industry in Sri Lanka that focuses on meat production
- The following breeds have their own inherited characteristics

eg. Fression's coat colour is black with white spots
Sahiwal breed inherit a loose skin and a hump

- Cattle breeds can be identified using their inherited characteristics
- It is important to select breeds which suit the relevant animal husbandry zones
  - Dry zone - Sahiwal, Sindi
  - Up country wet zone - Freassion, Ayrshire
  - Mid country wet zone - Jerssy, AMZ
  - Low country wet zone - Sahiwal, Jerssy
  - Coconut Triangle - Jerssy, Sahiwal
  - Jaffna Persula - Freassion, Ayrshier
- Practice of same will generate high level production
- Buffalo breeds such as Murah, Surthi and Niliravi are reared in Sri Lanka
- These breeds are reared for milk and draught purposes
- The relevant breeds can be identified through inherited characteristics
- A considerable increase in cattle population has been visible in Sri Lanka during the last few years
- The north western province is the region where, there is a vast distribution of cattle visible in Sri Lanka
- There has been is a considerable increase in milk production during past few years
- A fluctuation in beef production has been visible during the past few years
- The difference in milk and meat production compared to the population growth is a key problem
- Therefore, the cattle industry has to be improved further
- Their is the potential for the same

Competency level 14.14 : Plan management practices of calves.

Duration : 04 periods.

Learning outcomes :

- Discusses the importance of calf management.
- Plans treatment requirements at birth of calfs.
- Describes the importance of colostrums at birth.
- Analyses the concentrates and roughages volume requirements in relation to age limits.
- Discusses control methods of the calf.

Teaching-learning process:

Engagement :

- Present the following photograph of a calf to the class.

- Let the students to identify the picture.
- Conduct a discussion highlighting following points.
  - The period from birth to one year is treated as the calf in cattle management.
  - Systematic management carries various objectives.
  - Proper management of calves leads to successful milk production in the future.

Proposed instructions for learning:

- Out of the calf groups listed below focus your attention on the group assign for you.
  - European – calves
  - Indian/Native/local calves
- Use the activities involve on the birth of calves assigned to your group.
- Discuss the management practices of the calves assigned to you from the themes listed below.
  - Colostrum

- Provision of spacing
- Feeding
- Milk feeding
- Other management activities

- Prepare to present your finding to the whole class.

Guidelines to the explanation of subject matter:

- Conduct a discussion highlighting following points.
- It is important to take care of calves at birth.
- The following practices are important for same.
  - clean the calf
  - eliminate respiratory issues
  - cut off the umbilical code and apply an antibiotic
  - Mark weight at birth
- It is important to provide colostrus within one hour of birth
- Milk produced during the first 4-5 days of lactation is referred to as colostrum. Allowing the calf to drink colostrum provides following benefits
  - immunisation
  - laxative effect
  - obtain highly digestible and high nutritional food
- If it is impossible to get colostrum from the cow, a substitute should be provided
- It is important to provide milk from the mother cow until weaning
- It can be done by allowing the calf to suck or fed be with milk in buckets
- There are advantages and disadvantages in these methods, the amount of milk should be provided per day is 10% of the body weight of the calf
- Today from birth, tender grasses or 50-100g of hay should be introduced to the calf
- By this, the calf will be train to take in roughage
- About 3 weeks from the birth, nutritive concentrate food supplements should be introduced
- At 2 1/2 -3 months, if the calf's birth weight has doubled it should be weaned from milk
- Hereafter the calf does not need milk for its nourishment.
- In addition to concentrates and roughage the calf or animal should be provided minerals
- Provide sufficient pure drinking water all the time
- During the few initial months of milking stage calves are reared in pens
- There should be sufficient space in the calf pen

eg. until 01 month a single cage – 0.75m^2/ calf
until 02 months a common cage – 1.5/ calf
until 03 months a common cage – 28^2/ calf

- There are advantages in providing pens for calves
  - secures from diseases
  - secures from adverse environmental conditions
- The following diseases are common in calf rearing
  - Naval infection, swelling of joints
  - digestive system infection
    eg. • Worm diseases
    • Cocsidiosis
  - Respiratory track infections - Pneumonia
- These diseases leads to weaken the calf or even death
- Therefore, precautions and appropriate treatment of diseases is very important
- Immunization is done at calf stage to protect it from diseases
- Maintenance of records is very important in successful calf management
- Ear tagging or tattooing is used to identify calves in calf management

Competency level 14.15: Follows suitable procedures for proper management of heifers and pregnant cows.

Duration : 04 periods.

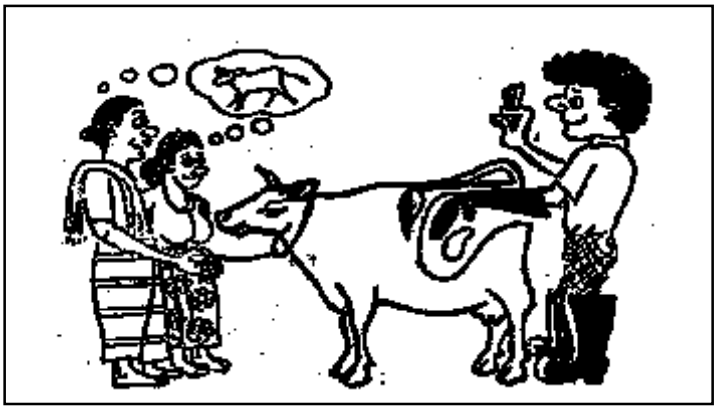
Learning outcomes :

- Identifies the cows which have signs of heat among the cows.
- Describes servicing methods of the cow.
- Describes feeding practices of the pregnant cow.
- Lists out parturition signs.
- Plans requirements for parturition.

Teaching-learning process:

Engagement :

- Present the following picture to the class.



- Lead a discussion highlighting the following points

  That,

  - It is important to have a calf per year in cattle management
  - The following practices should be followed properly
    - servicing and maintenance of the cow
    - parturition of the calf
  - Maintaining these practices properly can ensure high production

Proposed instructions for learning:

- Focus your attention on the topic assigned to your group from among the following
  - European cattle breeds
  - Indian cattle breeds
- Describe feeding of the heifers relevant to your group.
- Describe the stages of the Oestrus cycle of cows.
- Identify the heat signs of relevant animals.
- Describe the methods used to inseminate these heifers.
- Describe the feeding practices of pregnant cows assigned to you.
- Investigate the parturition signs of the pregnant cow.
- Describe the practices involved in the parturition of the pregnant cow.
- Present your findings to the whole class creatively.

Guidelines to the explanation of subject matter:

- Conduct a discussion highlighting the following points.
- The reproductive system of a cow consists of the following parts
  - ovaries
  - fallopian tubes
  - uterus
  - vulva
- Ova and sexual hormones are produced in the ovaries
- Fertilization takes place in the fallopian tubes
- The embryo implants in the uterus
- Sperm deposition and parturition both occur through the vagina
- Mucus is screeted from the vulva
- The first ovulation from the ovary is referred to as puberty
- These are called cows attained puberty or heifers.
- Once the animal reaches 1/3 of the mature body weight is referred as a sexually mature one
- It is important to select mature cows for servicing
- Nutrial requirements of these cows should be provided properly
- After puberty once in 21 days ovulation takes place
- The stage of ovulation is refered to as heat
- Cows in heat should be properly handled.
- The duration between start of one heat to the start of the next heat is described the as oestrus cycle

- With the iestrus cycle there are various physiological changes taking place in ovaries, uterus and vagina
- According to the above changes oestrus cycle is divided in to four stages
  - Pre heat – 02 – 03 days
  - Fleat - 18 hrs
  - Die oestrus – 02-03 days
  - Meso oestrus – 12 – 13 days
- The stage prior to heat is referred to as pro heat/ pro oestrus
- During this period the reproductive system prepares for ovulation through
  - Initiation of the folicle development
  - Secretion of mucus from the cervix
- The period where the cow is ready mating referred to the oestrus heat period
- during the oestrus/ heat period ovulation takes place
- During the oestrus stage changes of physiological activities and behaviour are visible
- These changes are referred to as signs of heat
  - uneasiness
  - allow mating
  - swelling in external sexual organs
- These characteristics are used to identify heat signs
- The latter part of the heat is referred to as dio-oestrus
- During this period physiological and behavioural changes seen during the heat period start to become normal
- The latter stage of the oestrus cycles, the duration between dio oestrus to the next heat is referred to as meso oestrus
- The Meso oestrus stage can be observed only when the cow has not become pregnant
- Out of the 4 stages servicing is effective only in the oestrus stage
- Heat signs can observed through a period of 18 hours
- During this period service can be done by insemination
- Service can be carried out by two different methods
- natural insemination
- Artificial insemination
- Natural insemination is the process of using a bull for the habitation process
- For this purpose a high standard stud bull is used
- Artificial insemination is the, collect that semen from a bull using artificial vagina and deposit same in a vagina of a cow which has come into heat
- There are advantages and disadvantages in both the natural and artificial insemination system

- After a successful insemination a cow becomes pregnant
- The gestation period of a cow is 285 days
- During the gestation period, the cow requires special attention
- Correct nutrition
- Weaning
- Approximately after 285 days, calving is referred as parturition
- By means of the signs shown on the eve of parturition it can be seen that the cow is about to deliver
- enlargement of udder
- expansion of vagina
- To facilitate parturition there are various practices to be followed
    - Separate from others
    - Provide lactative feed
- By mean of these practices a healthy calf and a quality milk production can ensured

Competency level 14.16 : Exhibits readiness to obtain high standard milk production from the cow

Duration : 05 periods.

Learning outcomes :

- Identifies the characteristics of a high productive milk cow.
- Describes structure of the mammary system of a cow by means of diagrams.
- Describes the mechanism of milk let down.
- Discusses the methods of milking.
- Inquires about the management practices in milking to obtain high quality milk.

Teaching-learning process:

Engagement :

- Present the following picture to the class.
- Inquires about the methods of milking with reference to the picture.

- Conduct a discussion highlighting the following points

  That,
  - Milk is produced in the mammary gland of a cow.
  - Removal of produced milk is referred to as milking.
- Milking can be done in two ways
  - hand milking
  - machine milking
- Various management activities are followed in the process of milking
- By means of these practices high quality milk can be obtained.
- Selection of a high standard cow leads to a high standard milk yield.

Proposed instructions for learning:

- Focus your attention on the topic assigned to your group, from among the following methods of milking.
  - Hand milking
  - Machine milking
- Describe the method of milking relevant to your group.
- Describe the structure of the mammary gland of a cow using a diagrams.
- Discuss the function of the mammary system of a cow on the following themes.
  - milk secretion
  - the mechanism of milk-letdown
  - factors that effect these functions
- Inquire about the characteristics of a successful milk cow.
- Present your findings to the class creatively and jointly.

Guidelines to the explanation of subject matter:

- Conduct a discussion highlighting following points.
- That, the main purpose of the mammary system is to generate milk for the purpose of feeding calves.
- The Mammary system is a modification of a swetting gland.
- The udder can be divided externally into four quarters such as left-right, front or rear
- The rear part of the udder is bigger than the front part of same
- Each quarter of the udder has a teat
- Milk glands are open to the teats
- The functions of the mammary gland is secretion of milk and the storage of milk
- Each mammary gland consists of a large number of globes
- Each globe consist of a large number of alveoli which has a layer of epithelial cells and a luman inside.
- Alveoli are connected to milk vessels
- These milk vessals are connected together and make milk ducts
- Milk ducts are open to the gland cistern
- The gland cistern is connected to the teat cistern and open through streak canal
- There is a blood and nerves supply to the alveola
- The function of the mammary system is as follows
  - Milk secretion
  - milk letdown
- Using digested material absorbed to blood in the digesting track of the cow, the micro-epithelial cells in the alveoli secrete milk into loman is referred as milk secretion

- This is a continuous process
- Prolactin Hormone is important for milk secretion
- Milk let low is referred to as milk produced at alveoli, released into the gland cistern and teat cistern influenced by external stimulation
- Milk let down is a nerval endocrine transaction
- The mechanising of milk let down as follows

Receiving of external stimulation

↓

Hypothalamus receive the nerve impulse

↓

Posterior globe of pituitary gland receive a message

↓

Production of oxitocine hormone

↓

Oxitocine received by alveoli glands through blood

↓

Contraction of musculo – epithelia surrounding of alveoli

↓

Squeezing of alveoli release milk through milk out to gland cistern

↓

Milk reaches to teat cistern

- Impact of oxitocine does not exist more than 5-8 minutes, therefore milking has to be done within that period
- Milking is referred to as, milk in the teat system taken out through streak canal
- Milking can be done in two ways as follows
  - Hand milking
    - Full hand milking
    - stripping
    - knuckling
  - Machine milking
    - Mobile machine
      - Combined milking machine
- Machine milking is faster and more efficient

- Application of suitable management practices leads to high quality milk production
- The following precaution are important for same
- milking related activities
- milking in a hygienical environment
- The following activities are very important in relation to milking
  - Prior to milking, wash udder and nipples using pure water and wipe
  - strip cup test
- This test is used to identify whether the cow is affected by mastitis
- A cup with a black piece of cloth over-covered and milk over it and carryout the test
- If clots, or change in colour of milk is visible, guess that cow is inflected with mastities
  - Treatment and milking of these cows done subsequently
- A mix of Vinegar and water or antiseptic solution can be used for this purpose
- Attention has to be focused on the situation listed below when milking hygienical
  - Cleanliness of the cow - wash the udder
  - Cleanliness of the cattle shed - remove dung/urine away from the shed
  - Cleanliness of the milker - cups/ hands used should be washed
  - Cleanliness of the containers - wash the containers
- Select a high standard cow to obtain high milk production
- The following features need to be considered in selecting a high standard milking cow

  position of
  - Head, neck and nature of these
  - Abdomen and body
  - blood circulation
  - shape of the body
  - heart girth
  - udder and milk vein

Competency level 14.17 : Plan conditions to obtain high quality and quantity milk production

Duration : 03 periods.

Learning outcomes :

- Names nutritional components of milk.
- Describe factors effecting the composition of milk and yield.
- Carries out tests related to milk.
- Inquires into the reason that effect reduction of milk quality.
- Identifies substandard milk.

Teaching-learning process:

Engagement :

- Present the following two samples of milk to the class
  - Milk with a high water content
  - Milk with a low water content differences
- Let student describe the difference between two sample
- Conduct a discussion highlighting following points
  - Milk is a product of mammals that contains a high level of nutrients and secrete by the mother animal after giving a birth
  - Composition and yield of milk can vary under different factors
  - There are various tests to measure the composition of milk
  - It is important to select high quality milk as feed

Proposed instructions for learning:

- Focus your attention on the methods of milking assigned to you from the methods listed below
  - Hand milking
  - Machine milking
- Use the resource book.
- Present the composition of milk relevant to your topic.
- Inquire about the factors that effect reduction of the quality of milk.
- Go to the work station.
- Using the equipment and materials find,
  - Fat percentage
  - Specific gravity
  - Solid non fat percentage of milk

- Examine the following characteristic of the milk sample assigned to you
  - colour
  - smell
  - taste of the milk
  - substances which have been added to reduce milk quality (adulterants)
- Prepare to present your findings to the entire class.

Instruction for the preparation of work stations:

- Arrange a work station to test the quality and composition of milk utilizing material and the equipment given.

Common inputs for all work stations

- Samples of cows milk.

Special inputs for work station I

- pipettes
- Hydro extractor/ centrifuge
- Lock key
- Amile Alcohol
- Butrometer
- Rubber stopper
- H_2SO_4

Special inputs for work station II

- Lactometer
- Measuring cylinder
- Thermometer

Special inputs for work station 3

- 10% potassium dichromate
- Iodine
- Ceramic containers
- Ferric chloride
- Either
- 2% citric acid
- Sliver nitrate
- Glycerin

- Concentrated Hydrochloric acid
- Diluted Sulfuric acid
- Phenolphthalein
- Dolica molib phospharic

Guidelines to the explanation of subject matter:

- Conduct a discussing highlighting the following points
  That,
  - Milk is a natural secretion produce in milk gland, consist of a high standard neutrious and considerable Taste.
  - The following components are the main consist in milk
    - Water
    - Protein
    - Fat
    - Lactose sugar
    - Vitamin
    - Minerals
  - Water is the main component of milk
  - It is around 80% of the total protein content
  - In addition to Keycine, whey, Protein, Lacto albumin and Lacto globulin consists in milk protein
  - Full cream milk consists of around 3% fat
  - Milk fat exist in the form of small globules
  - Fatty Acids such as butric, caproic caprilic, Capric contributes a comparatively high percentages to milk
  - Milk also contains phospho-lipids
  - The main carbohydrate in milk is lactose - sugar
  - Around 5% lactose is contained in milk
  - Milk carries essential vitamins and a source of various minerals
  - The following factors affect the position of milk
    - Breed and species of animal
    - Lactation stage
    - feed
    - diseases related to the udder
  - The following factors effect yield of milk
    - Breed and Species of animal
    - Health of the cow

- Age of the cow
- lactation stage
- Maintenance during Dry Periods
- Nutrient level and Feed
- Milking interval and frequency
- Milking method

- The following tests are carried out to test the composition of milk
  - Fat percentage - Gerbur method
  - Specific gravity - Lactometer method
  - SNF (Finding out so lid non fat)
- But observing (tasting) the taste, smell, Temperate, cleanliness the quality of the milk can determine this
- The quality of milk is reduced as a result of adding of foreign materials to milk by milk producers (adulterants)

  eg. water, salt, milk powder, flour, coconut milk
- Adulteration can be checked by chemical testing.

Competency level 14.18 : Plans cattle sheds according to rearing system.

Duration : 03 periods.

Learning outcomes :

- Describes the rearing system of cattle.
- Describes the requirements of cattle sheds.
- Compares the type of housing for cattle.
- Describes the factors to be considered when selecting a location for a house.
- Inquires about the conditions and the required equipment in the house.

Teaching-learning process:

Engagement :

- Present the following dialogue to the class using two volunteers

Uncle	:	Where are you running this evening
Son	:	Oh, uncle our Ratti and Handaya both are missing and I am looking for them.
Uncle	:	Why, by this time they should have been in the shed
Son	:	We don't have a cattle shed.
Uncle	:	If you are looking for a profit on cattle, you have to provide a shed for them. Did you see the beauty of my cattle shed.
Son	:	That's right I'll drop in tomorrow to get further detail.

- With reference to the above dialogue.
- Ask the students, the impotance of providing housing to cattle.
- Lead a discussion highlighting the following points .That,
  - Methods of cattle rearing in Sri Lanka are as follows
    - Free range system
    - Intensive system.
- Under the intensive system, animal are given permanent housing / shelter.
- Production can be increased by providing housing for animal.

Proposed instructions for learning:

- Among the following growth stages of cattle, pay your attention to the growth stage assigned to you.
  - Growing cattle.
  - Mature cattle (bull)
- Identify rearing methods of cattle relevant to your group.
- Discuss the advantages and disadvantages of these methods.
- Discuss factors to be considered when constructing of cattle shed, following them.
  - Requirements.
  - Selecting a location.
  - Types of housing.
  - Equipment requirements.
  - Space requirements.
- Prepare to present your findings creatively, to the entire class.

Guidelines to the explanation of subject matter:

- Conduct a discussion highlighting the following points.
- That animals are allowed to graze freely in the day time, is referred to as the free range system.
- This method is suitable for dry zones which have large extenents of land.
- This method is suitable for cattle that have Indian and local blood.
- There are advantages and disadvantages in the free range system.
- advantages-

  eg: cost of feed and housing is low.
- disadvantages-

  eg: animals are susceptible to parasitic diseases.
- rearing fulltime in a cattle shed is referred to as intensive system.
- Select high productive animals to rear under this method.
- There are advantages and disadvantages in this method.
  - advantages- easy to manage.
  - disadvantages- cost of feed and labour is high.
- Type of the cattle shed depends on the rearing system.
- Permanent houses are provided when rearing cattle under the intensive system.
- Houses made for the intensive system are of two types.
  - Loose houses- open system
  - Conventional houses- closed system

- In the loose house system rest of the time other than milking and treatment allows cattle to move freely in the house.
- In the conventional house animals are tethered the whole day.
- In the conventional house there are separate locations for different growth stages.
  - calf pen
  - housing for cows
  - housing for heifers/ growers
  - housing for bull/ male animals
- There are two types of closed house systems made for cows.
  - Single row system- when the number of animal small
  - Double row system- number of cows between 16-20
- There are two housing types in the double row system.
  - head to head system
  - tail to tail system
- Factors to be considered when constructing a cattle shed
  - Selecting locations- eg: drainage facility.
  - Space requirement- calf- 0.75-1.5 m2
  - Equipment- feeders
  - Types of houses- eg: head to head
- By providing houses based on the rearing system a high level of production can be obtained.

Competency level 14.19 : Exhibits readiness to ensure optimum animal production by inquiring management practices.

Duration : 04 periods.

Learning outcomes :

- Discusses the importance of animal health management.
- Names disease symptoms of animals.
- Classifies causal agents of diseases.
- Describes factors that cause diseases.
- Describes disease control methods.

Teaching-learning process:

Engagement :

- Present the following dialogue to the class using two volunteers.

Herath	:	Ranbandiya why do you look as if you have bought for pounds and sold for shillings.
Ranbanda	:	Oh! Herath malli a disaster, my poultry farm is over, all of them are sick.
Herath	:	How do you know?
Ranbanda	:	Birds are not active as usual and they don't eat as well. Just keep quiet with folded wings. Had laid only a few eggs today.
Herath	:	Sounds like they have caught a disease. Then only they behave in such a way. They don't eat as usual and won't lay eggs.

- Let students to highlight that, disease is a deviation from a normal condition and lead a discussion highlighting the following points.
  - animal health is important to obtain high quality and high production
  - there are various reasons outbreak of diseases
- The following practices can be adapted in disease management
  - Immunization
  - Quarantine

- Treatments for infected animals

- Suggested instructions for learning.
  - Focus your attention on the animal group assigned to your group from the group listed below.
    - poultry
    - cattle
  - Use the resource book.
  - Describe the factors that lead to diseases, to the animal group assigned to you
  - What are the common symptoms of diseased animals relevant to your group
  - Describe the importance of animal health management
  - Discuss the disease control methods from the following themes
  - Immunization
  - quarantine
  - Treatment of infected animals

Guidelines to the explanation of subject matter:

- Conduct a discussion highlighting the following points.
  - Production of farm animals depends on various factors
    - Genetic potential
    - Nutritional condition
    - Reproductive efficiency
    - health condition
  - Bad health condition affect farm animals adversely as follows
    - retardation of growth
    - reduction of production
    - Reduction of reproductive efficiency
    - death of animals
  - Therefore, to obtain maximum financial benefits, management of animal health is very important
  - Affected animal can identify by disease symptom
  - External disease symptoms
    - reduction of brightness of eyes
    - reduction of feed intake
    - abnormal behaviour
    - curtailed of production
  - Disease which cannot be diagnosed from external signs
    - change in body temperature

- change in pulse rate
- erratic respiratory rate

- The following are the factors that cause diseases
- Infectious diseases
  - Bacteria
  - Virus
  - Parasitic
- Non infectious diseases
  - Metabolic disorders
  - Imbalance nutrition
  - Genetic factors
  - Adverse environmental conditions and management practices
  - Toxicity
- The following practices can be adopted to control animal diseases
  - Immunization
  - Quarantine methods
  - Treatment of infected animals
  - High production can be ensured by controlling animal disease

Competency level 14.20 : Identifies animal diseases and plans management practices

Duration : 05 periods.

Learning outcomes :

- Names the important diseases that affect cattle and poultry, respectively.
- Identifies the causal agents of disease.
- Diagnoses poultry and cattle diseases based on symptoms.
- Names diseases that are transmitted from farm animals to humans (zoonatic diseases)
- Describes the practices involved in controlling diseases.

Teaching-learning process:

Engagement :

- Present the following photographs that consist of infected animals and healthy animals to the class.


- Inquire from students about the differences between the two photographs.
- Conduct a discussion highlighting the following points in relation to the above. That,
  - In the poultry and cattle industry there are various disease that affect the animals
  - Certain diseases are transmitted to humans from animals
  - Production drops due to disease
  - Therefore, prevention of diseases is important

Proposed instructions for learning:

- Focus your attention on the animal group assigned to you from the animal group listed below
  - Broiler chicken – European cattle
  - Hen – Indian cattle
- List out the diseases that affect the animal group assigned to you

- Discuss each of these diseases under the following themes
  - Causal agent of disease and method of contamination
  - disease symptoms
  - control and treatment
- Identify the diseases which can be transmitted from farm animals to humans (zoonatic diseases).
- Describe the mode of transmission of same.
- Prepare to present your findings to the whole class.

Guidelines to the explanation of subject matter:

- Conduct a discussion highlighting the following points
  That,
  - Animals are susceptible to different diseases in the cattle & poultry industry
  - Key diseases that affected cattle are
    - Work infestation, Milk fever, Mastitis, Food and mouth disease, Haemoragic septicemia, Tick fever, bloating
  - The causal agents of the above diseases are as follows

Disease	Causal agent
Worm disease	Worms in intestine
Milk fever	metabolic disease
Mastitis	Bacteria Streptococcus
Foot and mouth disease	Aptho virus
Haemoregic septecemia	Bacteria
Tick fever	Babesia bigemia Babesia bovis (Protozoa)
Bloating	Imbalanced feeding or any other disease condition

  - The main diseases that affected poultry are Worm disease, Pullorum disease, Cocidiosis, Gamboro, Avipox virus, Raniket
  - Causal agents of same are listed as follows
  - Poultry and cattle diseases can be identified by disease symptoms/ clinical signs
  - Certain diseases are transmitted to humans from animals
    eg. mad cow disease, bird flue, Brucellosis
  - To control these diseases
    - maintain sanitary conditions in the farm
    - vaccination at right time
    - treatment of affected animal
  - Acquire high standard production by the elimination of diseases

Competency level 14.21 : Plans a small scale farm.

Duration : 02 periods.

Learning outcomes :

- Presents the factors to be considered on starting an animal farm.
- Decides on the number of animals that can be reared and the nature of the farm, based on requirement and ability.
- Discusses inputs required for a farm and method of obtaining the required services.
- Plans to implement a farm.
- Discusses methods of maximizing farm profitability.

Teaching-learning process:

Engagement :

- Present the following dialogue using two volunteers.
- A dialogue between an agriculture teacher and a student has left school after G.C.E. A.L.

Piyal	:	Sir, where are you up to?
Teacher	:	I am on a way to town what are doing after the exam are you doing a job.
Piyal	:	No sir, I am plan to start a small farm. I have already done the relevant plan.
Teacher	:	Good you are going to be a farm owner. Make use of what you learned and starting a business like this is excellent.
Piyal	:	Thanks sir

- Inquire from students the factors to be evaluated at the point of planning an animal farm.

- Conduct a discussion highlighting following points.
  That"
  - The following animals can reared in an animal farm
    - poultry
    - cattle
    - swine
    - goat
  - Considering the various requirements select an animal species for the farm.
  - There are various factors to be considered, in planning the farm for the selected species.
    eg.
    - required input
    - cost
    - revenue
  - Accurate planning leads to generate high profitability.

Proposed instructions for learning:

- Focus your attention on the type of animal farm assigned to you from the farm types listed below
  - a farm that consist of milking cows
  - Broilers – a farm that consist of 50 layers/broilers
- Use the resource book.
- Related to farm type assigned to you, discuss the factors to be considered from the following themes in order to rear animals under the intensive system
  - expenditure
  - revenue
  - required inputs
  - services
  - strategies of maximizing profit
  - method of waste disposal
- Plan an farm for the relevant number of animals according to the type of farm assigned to you, at your residential area.
- Prepare to present your findings creatively to the whole class.

Guidelines to the explanation of subject matter:

- Conduct a discussion highlighting the following points.
  - Proper planning is very important to start a large scale or even a small scale animal farm
  - The producer can enjoy a high profitability through this practice
  - First of all, ensure whether there is a market for the products
  - Plan an animal farm that consists 50 number of layers/ Broilers and 4 numbers of milking cows, reared under the intensive method
  - Special attention has to be focused on the following factors when planning the animal farm above
    - Expenses
    - Revenue
    - Required inputs
    - Services
    - Profit maximization strategies
    - Disposal of waste
  - Planning of a farm consist of various components
    - Capital expenditure – eg. animals, purchase of equipment
    - Working capital/Recurrent cost' – eg. feed, medicine
  - Farm expenditure can be categorised as follows:
    - Milk farm – Housing for cattle, calf pens storage
    - Poultry farm – Housing of poultry, office, food storage
  - Estimation of these expenses is very important
  - There is need to plan the production output of the farm
  - Poultry farm – eggs, meat, manure etc.
  - Milk farm – quantity of milk, manure, calves
  - Revenue generated from the farm has to be estimated
  - By estimating expenses and income, profitability can be ensured
  - Using various strategies the profitability of the farm can be maximised
    eg.
    - Broilers offered to the market at the age of 35 days
    - Apply preservation methods for milk
  - There are various ways of catering to, inputs and services required for a farm
    eg.
    - Veterinary service
    - Obtain loan facilities from Banks

- Application of suitable techniques to dispose of waste in the farm, is the social responsibility of the farmer
- There are various methods that can be applied
  eg.
  - Constructing Bio gas units
  - Converting to fertilizer
- Factors such as situation of the area, demand, investment capacity and financial capacity decides on the number of animals that can be reared on the farm
- Requirements of space feed troughs, water troughs, of animals are estimated based on the above.

Competency level 14.22 : Plans maintenance of farm records for a successful animal farm.

Duration : 03 periods.

Learning outcomes :

- Describes the necessity of record keeping for an animal farm.
- Names various farm records.
- Classifies farm records.
- Selects necessary records according to rearing of existing farm animals.
- Prepares farm records.

Teaching-learning process:

Engagement :

- Present the following incident aloud, using a volunteer student.

Case study

A farmer who wanted to buy a calf, met the farm manager at "Araliya Kelle". He informed him that he wanted to buy a cross breed called Jersy, to the manger and the manager called over Mr. Piyasoma who is incharge of that section. The manager explained the farmers requirement to Piyasoma and advised him to provide information regarding a calf referringS to the relevant records. Piyasoma managed to locate information regarding a Jersy cross calf by going through the birth register.

Using pedigree records he managed to locate information regarding material and paternal parties and production records of these in a short while and presented it to the manager. The farmer was happy as he managed to get his job done without wasting time unnecessarily.

Proposed instructions for learning:

- Focus your attention on the farm assigned to you which rears the animals listed below.
- Farm raring cows
- Farm rearing hens (layers), Broillers
- Use the resource book.
- Describe the type of records that should be maintain in the farm in the process of rearing the animal group assigned to you.

- Describe the requirements and advantages of keeping these records.
- Prepare to present your findings to the whole class creatively and collectively.

Guidelines to the explanation of subject matter:

- Conduct a discussion highlighting the following points.
  - There is need to maintain farm records, when animal husbandry is done in a business level
  - Farm owners acquire various advantages as a result of maintaining farm records
  - Facilitate management activities
  - Derive the profitability easily
  - There are two types of records maintain in a farm
  - Physical records
    - Financial records
    - Physical records
  - Physical records can be catagorised as follows
    - Primary records
    - Summary records
  - The maintained records related to day to day activities are refers Primary records eg.
    - Daily feed register
    - Death reports
    - Treatment register
  - Summary records are prepared by using primary records
  - Following key records are maintained in a farm
    - production records
    - Pedigree records
    - Birth registers
    - Culling records
  - Production reports are maintain in both primary and summary record form
  - Primary records are mainly maintained over a period of a month
  - At the end of the month the particular month's primary records corrected in to a summary record
  - By means of the summary report, if it is a layer farm, compare the amount of Feed) provided, during a particular period vs. the amount of eggs yield gained during the said period the production cost per egg and, the number of egg output against the volume of feed can be estimated

- In a broiler farm, birds live weight, death percentage are treated as primary records. Total death percentage, feed consumption per bird per day and feed conversion efficiency are treated as summary records maintained.
- In a Dairy farm daily milk production of each cow is maintained as primary records
- Based on the relevant data, volume of concentrate feed required to produce a litre of milk can be estimated
- Pedigree Record consist of animals date of birth, age, body characteristics, production capacity, age range that produces optimum production, and details of parents
- Pedigree records are important in the process of cross breeding
- The record which contain Date of Birth and time is referred to as birth register
- This register is important for, vaccination programmes, medical treatment and insemination
- Records consist of Date of insemination, the information on the male animal used to obtain semen, is referred to as insemination records
- The unsuitable animal are removed and the relevant information is recorded in the culling record

Competency 15.0 : Plans consumption methods of quality food for healthy life.

Competency level 15.1 : Select suitable food for consumption considering nutrient components.

Duration : 03 periods.

Learning outcomes :

- Names the nutrient component in an item of food.
- Provides examples of macro and micro nutrients.
- Describe the importance of various nutrient components related to human nutrition.
- Prepares a menu for a meal which provides nutrient components at optimum level.
- Explains the importance of a balanced diet.

Teaching-learning process:

Engagement :

- Present a poster or a picture that contains nutrient component.
- Conduct a discussion highlighting the following points.
  That,
  - Nutrition is an important factor for a healthy life.
  - Carbohydrate, Protein, Lipids and water are important as macro nutrients of food.
  - Vitamin and Minerals are important as micro nutrients of food.
  - Arrangements for a balanced diet leads to good nourishment.

Proposed instructions for learning:

- From the food components listed below focus your attention on the component assigned to you.
  - carbohydrates - lipids - minerals
  - protein, water, vitamin, fibre
- Define "human nutrition"
- Categorize the given components under micro and macro components.
- Present reasons for the same.
- Describe the importance of nutrient components assigned to your group.
- Describe the importance of fibre.
- How to select food for meals as per food pyramid and food selection criteria.

- Prepare a suitable menu for a balanced diet that has of nutritional value, and quantity.
- Prepare to present your findings to the entire class.

Guidelines to the explanation of subject matter:

- Lead a discussion highlighting the following points.
  That,
  - Among the nutrients components carbohydrate is required excessively
  - carbohydrates can be categorized as monosaccharides, disaccharides and polysaccharides
  - Carbohydrates contribute to various functions of the body
    eg. provide energy
    construct materials etc.
  - Lipids include oils and fats
  - Fats are divided into two categories as saturated fatty acid and unsaturated fatty acids
  - Fatty acids which be cannot Synthesised within the human body are referred to as essential fatty acids
  - Lipids can be acquired from various foods
  - Lipids contribute to various functions of the body
    eg. Production of cholesterol
    growth of the brain
  - Protein consists of Amino Acid
  - Amino acid is divide into two categories as essential an non essential
  - Protein carry out various functions
    e.g growth of body cells
    Repair of cells and tissues
  - Vitamin can be divided into two categories as vitamin that dissolve in water and those that dissolve in oil
  - There are various advantages of vitamin A
    eg. Improve eye sight
  - There is a complex of Vitamin 'B'
  - Each compound which consists of vitamin B performs different functions.
    eg. Thiamin - Stimulates Metabolic activities, reacts as a component of riboflavin and enzymes
  - Vitamin C is important for the growth of bones and teeth and Metabolic Activities.
  - Vitamin D is essential for the mineralization of bones and body growth

- Mineral salt is divided into two categories based on the daily requirement by the body as macro and micro mineral salts
- Calcium and phosphorus are essential for the growth of bones and teeth
- Magnesium is important for the function of enzymes and Proteins
- Sodium and Potassium is essential to maintain water equilibrium in the body
- Sulphor is important for the growth of muscules, hair and nails
- Iodine is important for the production of the hormon thyroxin
- Iron is important for production of Haemoglobin
- Zink is important for Metabolic Activities
- Various requirements of the body are catered to by, Selenium, fluorine, copper, manganese, chromium and molybdenum
- There are a few factors effecting the bio-availability of minerals
  eg. food preparation, foods that consist of anti nutrients
- 2-3 lts, of water should be drunk per day
- There are a various advantages of water
  eg. Metabolic activities - Excretion
- Although fitness doesn't contribute to nourishing it is an essential component of meals
- There are various advantages of fibre
- It is necessary to have nourishing food that consist of all nutritional components in correct proportions
- These are referred to as a balanced diet
- The amount of nutrition which should be obtained from the food displayed in the food pyramid
- Meals can be prepared considering the various nutrients values available in food

Competency level 15.2 : Plans to identify the factors contribute to food spoilage and control

Duration : 05 periods.

Learning outcomes :

- Describes the characteristics of spoiled food.
- Names the various factors that cause food spoilage.
- Describes how chemical factors spoil food.
- Names the Biological factors that cause for food spoilage.
- Describes what happens after eating spoilt food.

Teaching-learning process:

Engagement :

- A fungus contaminated piece of bread, wrapped in polythene, some spoilt rice. A sample of spoilt milk, Pest attacked potato yam and a mango. trays consisting the above samples is passed to all the students of the class to facilitate them to observe.
- Inquire from the students how to identify food that has been converted to an inedible condition.
- Conduct a discussion highlighting the following points.
  - If, appearance, smell, taste, colour and texture of an item of food has changed, it is referred as spoilt food.
  - There are various features to identify spoilt food.
  - Physical, chemical and biological factors cause food spoilage.
  - There is need to be concerned about these factors for proper nutrition

Proposed instructions for learning:

- Focus your attention on the topic assigned you from among the following.
  - Physical factors that effect food spoilage
  - Chemical factors that effect food spoilage
  - Micro and macro organisms that influence food spoilage
- Introduce the concept of food spoilage.
- List out the characteristics of spoilt food.
- Do a research on the following themes for the topic assigned to you
  - Introduction of topic
  - The process of the spoilage due to the factor assigned to you
- Describe the adverse outcomes of food spoilage.
- Prepare to present your findings to your class.

Guidelines to the explanation of subject matter:

- Conduct a discussion highlighting undermention points
  That,
  - Changes in a characteristics of food such as taste, smell, colour and texture to the extent of inedible levels referred to as food spoilage
  - Spoiled food can be identified by means of its own inherited features
  - Spoiled food has features such as changes in taste, smell, texture and stickiness
  - The following factors cause food spoilage through physical factors, chemical factors, biological factors (micro and macro organism)
  - Temperature as a Physical factor has a direct influence and indirect influence on for food spoilage
  - Temperature influences growth of micro organisms which spoil food, reactions of enzymes and Protein coagulation
  - Water as a physical factor influences food spoilage
  - The moisture percentage of the food also facilitates microbial growth and spoil the food
  - pH value as a chemical factor influences enzymatic reactions and oxidation and spoils food
  - At various pH value ranges micro organisms invade food and spoils it
  - Oxidation reaction, Browning reaction and Fermentation leads to food spoilage
  - Micro organism such as (Fungi, Bacteria, Yeast) are key agents of spoilage of food
  - Under optimum conditions micro organism grow rapidly on the food and spoils it
  - Various types of spoilages is caused by various micro organism groups
  - Various animals such as insects, rodents, birds also contribute to food spoilage
  - As a result of eating spoilt food, toxicity, allergies and diseases or death can occur
  - By means of controlling the factors that cause food spoilage, food security can achieved

Competency level 15.3 : Plan various techniques for food preservation

Duration : 03 periods.

Learning outcomes :

- Creates graphics to highlight methods of food preservation.
- Highlights the principles that govern food preservation.
- Applies various techniques of food preservation.
- Evinces readiness to acquire economic advantages by reducing wastage of food.
- Proposes appropriate food preservation methods based on type of food.

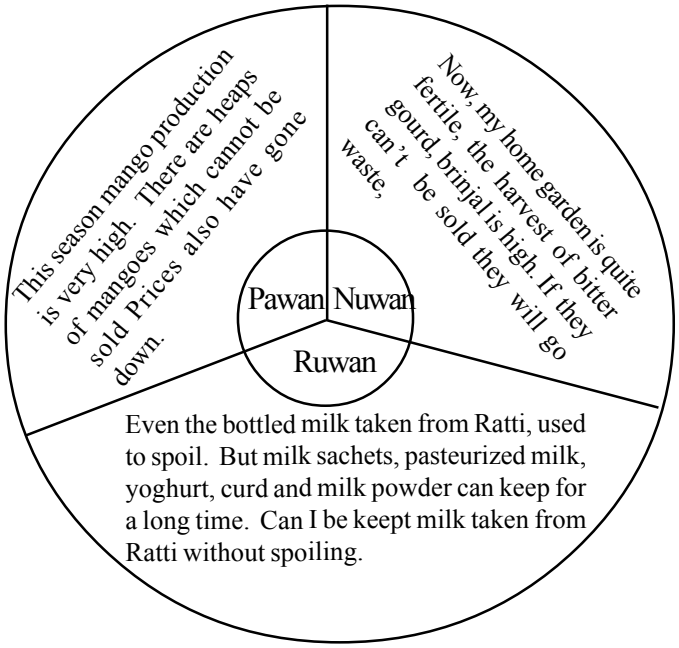
Teaching-learning process:

Engagement :

- Display preserved samples of food items.
- Direct student to discuss the method of processing these items of food.
- Conduct a discussion highlighting the following points.

  That,
  - Most Agricultural Products are seasonal
  - Therefore, losses and waste are incurred
  - By means of controlling factors related to food spoilage, the retention period (shelf life) of the food can extended
  - There are various methods for same
    - Control of temperature
    - De-hydration
    - Concentration

Proposed instructions for learning:



- Focus your attention, on the problem presented by the diagram
  - Pavan's problem
  - Ruwan's problem
  - Nuwan's problem
- By referring to the resource book, find out solutions for the problem assigned to you and identify the practices and preservative methods and relative principles of same.
- Under each preservative systems, list out examples of food which can be preserved under each system.
- Go to the work station
- Describe preservation methods of each food.
- Present your findings to the class.

Instruction for the preparation of work stations:

- Using the given material and equipment, arrange three work stations focusing following activities.
  - Preparation of yoghurt
  - Mango chutney
  - Drying of vegetables

Common inputs for all work stations

- Pure water
- One or two plastic basins to wash vegetables and fruits
- Cutting board
- Gas cooker
- Thermometer
- Enamel/clay pots
- knives

Special inputs for work station 1

- fresh milk
- a yoghurt to obtain inoculums
- suitable containers to prepare yoghurt
- 40W/60W bulb
- a box insulated with Styrofoam
- refrigerator
- wooden spoon

Special inputs for work station 2

- A few mature and ripe mangoes
- vinegar
- sugar
- stainless steel pots
- wooden spoon with long handle
- container for sterile bottles
- bottles for packing

Special inputs for work station 3

- fresh vegetable (bitter gourd, bringal, carrot, been)
- 1% solution of sodium meta bisulphate
- piece of cotton cloth
- a solar drier

Guidelines to the explanation of subject matter:

- Conduct a discussion highlighting the following points.
  - Avoiding diseases incurred by eating spoilt food, prevention of wastage, nutrients in food, taste, texture and maintenance of appearance as much as possible by controlling the factors that effect food spoilage, design of packaging and keeping for a long period referred to as Food Preservation.
  - It leads to
    - Minimize food waste
    - Reduce price fluctuation in the market
    - Cater to the nutrient requirements of the people
    - Improve the consumer's appetite
  - Food preservation is done under a few principles
    - Inactivate of enzyme
    - Inactivate micro organism
    - Minimize damage caused by macro organism
    - Present chemical reactions
    - minimize physical damage
  - There are various preservation methods under the preservation principles above
  - There are two preservation methods under the principle of temperature control
    - Food preservation by increasing temperature
    - Food preservation by reducing temperature
  - Under high temperature micro organism which cannot bear the temperature will become inactive or destroyed
  - There are various methods or food preservation under the application of high temperature
    - Sterilization
    - Pasteurization
    - Blanching
    - Tenderisation
  - Application of sterilization under high temperature destroys all micro-organisms
  - Sterilized of food can be retained for a longer period by using sutable packing in such a way that micro organisms cannot reach the food.
    eg. sterilized milk, sterilized fruit juice
  - In sterilized food, while certain vitamins and nutrient are destroyed, taste can change
  - In the process of pasteurization, although the temperature is increased it is a lower temperature compared to the temperature applied in sterilizing techniques

- In the process of pasteurization it destroys only the pathogenic micro organisms which spoil food
- All micro organism won't be destroyed in the process of pasteurization
- Pasteurization, can be done in several methods (GT ST)
  - High temperature short time, method
  - High temperature method
  - Low temperature, longer time method (LTLT)
- By pasteurization causal agents of the following diseases can destroyed (micro organism)
  - Tuberculosis
  - Diphtheria
  - Cholera
  - Diarrhoea
  - Typhoid
- Changes in taste and nutritional quality of pasteurized food is minimal
- In the process of blanching, it is possible to preserve foods without changing colour and texture
- Blanching is a pre-treatment system
- Blanched food can be preserved by Deep freezing, canning or drying
- There are three methods of blanching
  - keep in hot water over 2-3 minutes (100^0C)
  - provide a steam supply
  - keep in microwave oven over a period of one minute
- Blanching is used to inactive enzymes in the food and destroy the micro organism on the surface of the food
- In blanching a little amount of sodium bi carbonate is added to the boiling water to prevent chlorosis (removal of green colour)
- In tenderization, preservation of food can be effected by increasing and decreasing temperature
- Food preservation also can be done under low temperature
- Three methods used for same
  - freezing/chilling
  - deep freezing
  - freeze drying
- Food is preserved by reducing the growth-rate and activity of micro organisms by applying low temperature
- Foods undergo less than 10^0C temperature in chilling/freezing

  - This process reduces the activity of micro organisms, and inactivation of enzymes happens to a certain extent
  - This method is not suitable for long term storage
- Food is preserved by keeping the food at low temperature of less than its freezing temperature (-1.5-(-2)^{0}C) is referred to as deep freezing.
- -18^{0}C is the most suitable temperature for this purpose.
- There are advantages in deep freezing
  - facilitates the transportation of food
  - protection of nutritional value/of food etc.
- Disadvantages of deep freezing are as follows
  - cells are destroyed
  - denaturation of protein
- In freeze-drying, foods are preserved by a dehydration activity
- Freeze drying is used in the production of instant coffee
- Reduction of the water activity of food leads to the prevention of microbial growth in the drying process
- Most of bacteria are destroyed by this method and storage should be done in airtight containers
- As a result of drying food it looses it's taste and texture, still people's appetite is for these products
- The following food can be preserve by drying
  - vegetables
  - fruit
  - meat
  - fish
- Food can be dried in an efficient manner by using a solar drier
- Milk powder is made by spraydrying
- When using sundrying, dust and other germs can mix with the food while a certain amount of the food is eaten by animals
- In concentration, food is soaked in a concentrated solution that helps to prevent microbial activity
- Several methods can be used for the above purpose
  - adding salt
  - adding sugar
  - adding honey

- In fermentation food is preserved by using microorganisms favourable to human
- Compounds produced as a result of the introduction of effective micro organism, reduces the growth and activities of harmful micro organism and creates an environment that extends the life of the food and provides the advantages such as appetite and facility in digesting to the consumer
- Fermentation can be described in three different ways
  - Lactic acid fermentation
  - Acetic acid fermentation
  - Alcohol fermentation
- Food preservation by smoking, leads to remove water from the food and add addition of taste
- There are two methods of smoking
  - Hot smoking
  - Cold smoking
- Irradiation is an improved food preservation system used in modern food technology
- In this process, waves (X rays and Gama rays) toxic to micro organism are passed through the food and micro-organisms are destroyed
- The is no damage made to the texture, composition or nutrients in the food by this method
- Canning is a method of facilitating customers who are unable to obtain natural food directly
- Food is sterilized prior to canning or it is irradiated after it is canned

Competency level 15.4 : Selects diversified foods using senses.

Duration : 02 periods.

Learning outcomes :

- Describes food diversification.
- Describes the methods of food enrichment and fortification.
- Names diversitied foods for domastic consumption
- Expresses measures to be taken to minimize hazards to human in food diversification

Teaching-learning process:

Engagement :

- Conduct a discussion by inquiring from students regarding preparation of food in different forms.
- Present the following dialogue for that purpose.

Daughter	:	Mother, how did you manage to dry the Goraka. It is rained all the day.
Mother	:	I used a new method. Since you can't dry in the rain.
Daughter	:	Actually what did you do for Goraka.
Mother	:	I can remember our grand mother used to ripen goraka and add some salt and boil it over a few days. Used a clean piece of stick to mix it and it will become creamy later on. I also did the same and part of the goraka was dried by smoking.
Daughter	:	It is a good job. Now it is easy and me need not grind and use directly.

Proposed instructions for learning:

- Focus your attention on the topic assigned to your group, from among the techniques used in food diversification
  - Enrichment
  - Fortification
- Describe the concept "Food diversification".

- Describe the Technique relevant your group used in food diversification.
- Give an examples to the topic assigned to your group in the field of food.
- Show examples relates to your topic in the food industry. (food products)
- Describe the advantages, disadvantages and extremes in consumption four diversified items of food.
- Most of your hygienic and nutrition problems can be overcome through "food diversification" make your comments on this.
- Prepare to present your findings to the class.

Guidelines to the explanation of subject matter:

- Conduct a discussion highlighting the following points
  That,
  - Presenting a food product in different forms to the market referred to as food diversification
    - Objectives of food diversification are easy – handling, invade market, increase market share, minimize waste, increase food availability, solution to health problems and provides various tastes and nutrients.
    - Control of Temperature, Fermentation, concentration, canning are the techniques applied in the process.
  - Improvement of nutrient or nutrients in a food is referred to as enrichment of food.
  - Nutrient or nutrients which are not naturally contained in food are added to food to give it an additional nutrition is refer as fortification.
  - To improve the commercial value of a product.
  - Value can be increased by adding a food product to any other food product is also a referred to as food diversification
  - Food diversification is a solution for certain health problems in society
  - Food diversification is facilitation or preparation of food for people who are busy with day to day work
  - Through food diversification a higher price can be got for agricultural products
  - In the process of food diversification a value is added to the product and the producer obtains an additional profit, therefore it is his responsibility to provide hygienic food to the customer at a reasonable price
  - There are advantages and disadvantages in food diversification

Competency level 15.5 : Selects food according to standards, rules and regulations.

Duration : 04 periods.

Learning outcomes :

- States the importance of standards, rules and regulations in food processing.
- Expresses informations about acts, institutes and standards important in consumer protection.
- Describes, effect of packaging and labeling to the security of food.
- Selects high standards food.
- Presents facts important in food standardizations.

Teaching-learning process:

Engagement :

- Food samples with or without SLS mark, food samples with or without ISO mark, and food samples with or without packing are presented to class.
- Inquire about the safety of these food samples.
- Inquire how to identify unsafe food.
- Examples for non safety of food and get views.
- Let students observe the information contained in the label (nutrients, flavours)
- Lead a discussion highlighting the following points

  That,
  - The consumer is concerned about the quality of the product consume
  - Certain food available in the market mislead customers and threaten their life
  - Standards, rules and regulations are important to secure the customer from malpractices in production and marketing of processed foods
  - Production, packaging, preservation, labeling and handling of additives are subject to rules and regulations and these are important for the selection of food.

Proposed instructions for learning:

- Focus your attention and the topic assigned to you among the topics listed below
  - Quality, standards, standard credibilities and acts.
  - Packaging and labeling
  - food additives
- Discuss your topic focusing attention on customer security in the field of food.
- Discuss the requirement and importance of the topic, to confirm the security of the customer in the field of food.

- Describe with examples, methodologies in practice, material use, and related concepts related to your topic.
- Go to the work station and carry out the following activities.
- Inspect and present your views regarding introduction of these products to the market whether they carry customer security or not.
- If not what are the actions that can be taken in such circumstances.
- Prepare to present your findings to the whole class.

Work station I

Required material - Bundle of green leaves, loaf of bread (un wrapped)

Work station II

Packet of Biscuits (wrapped)/ or tin of salmon

Work station III

Yoghurt/ Curd, Packet of Black gram (a suitable one from these)

Guidelines to the explanation of subject matter:

- Conduct a discussion highlighting the following points.
  That,
  - The customer is very concerned about selecting high standard prepared food products for his own safety
  - Quality control is the process of ensuring that the finished product and its packaging are on line with standards accepted by scientific analysis
  - Application of required standards and production methods, in the total process of manufacturing such as quality control of raw material, ensure quality standards at various steps in the process are referred to as quality assurance
  - Good manufacturing practices and HACCP are important for the same (Hazard Analysis Critical Control point)
  - Quality assurance creates a customer confidence, minimizes pollution and get high recognition for the product
  - Food standardization is the process of ensuring, that the product Purchases by the customer carries the features stipulated
  - When a product carries minimal value of required component, the quality of such product and suitability of same, is minimal and consists of maximum value of components which effect reduction of quality or components which do not suit the consumer, are the limiting factors to determine substandard

- According to the existing social pattern, the life style of the human and food habits has changed accordingly
- To suit the situation new products, storage production techniques have been invented
- Since food has direct influence on nutrition and health it is important to control quality standards in food the industry
- The consumer should be secured from adulteration of food, Providing incorrect information regarding standards of food against business ethics
- The main objects of quality control is to protect the consumer from the above
- Catering according to customer expectations is the manufacturer's responsibility and at the same time and it is the responsibility of the government to ensure that high standard quality products are supplied to the people
- Standards, rules and regulations are important as follows
  - Secure consumers
  - Consumer can secure himself
  - Since high quality products have a high demand it is profitable to the manufacture also
  - Establishes identity of the product, high standard and safety
  - Generates a healthy generation
  - The amount of money spent on disease (treatment) can be used for many other purpose
  - Increases efficiency of utilization of resources
  - Minimizes food spoilage
  - Increases organizational productivity through production of high standard products
  - Foreign exchange can be earned, by means of high standard food production
- The following factors are considered in the process of food standardization
  - Nutritional value, chemicals, purity, disposal method of waste, health and safety measures in the process, packing material
- The following are the organizations and standards to secure customers in Sri Lanka

  Institute -
  - Sri Lanka Standards Institute (SLSI)
  - Ministry of Health Care and Nutrition
  - Consumer Affairs Authority
  - Department of Measurements, Standards and Services

Standards - Sri Lanka Standards
International Standards
Company Standards
Institutional Standards
Zonal Standards

- The standards valid in Sri Lanka were introduced by the Sri Lanka Standard Institute
- ISO and SLS standards are active in Sri Lanka
- The credibility certificate issued by Sri Lanka Standard Institute is displayed under the SLS mark
- SLS issues a quality certificate based on independent standard of food products such as GHP (Good Harvesting Practices), GMP (Good Manufacturing Practices), HACCP (Hazards Analysis Critical Control Point)
- ISO is the short term for International Standard Organization and it's credibility is internationally valid
- SLS has authority to issue ISO certificates
- The benefits such as improvement of productivity efficiency and reduction of waste, improvement of customer satisfaction and confidence, reduction of cost of material and services obtained can be acquired through the Application of standardization certificates
- Relevant rules and regulations have been gazetted under the food act of 1980 no. 26 and the director of Health Services is the sole authority responsible
- Standards under the food act and orders composed are published by gazette
- Food products which are caused Personal Health Hazardous, Quality reduced and unfit for the consumer are not allowed to be produced, imported, distributed or sold
- This act is imposed under Ministry of Health Care and Nutrition
- Objectives of the act are as follows
  - Ensure the activities of Food Production, Imports, Distribution and Sales are in order and managed
  - Discarded food and drugs act
  - Appoint a Food advisory committee
- Under clause 32 of the act regarding Food Production, Imports, Sales, Storage and Displaying the required regulations are established
- For the security of the consumer the act of superintendent of consumer affairs (2003 no. 9) was established

- The following aims are fulfilled by this Act
  - Secure consumers (marketing of goods which are hazardous to life and property of consumer)
  - Stand against unfair trade practices and concern about security of customer rights
  - Ensure that wherever possible consumers have adequate access to goods and services at competitive pieces.
  - Seen redress against unfair trade practices.
  - Assist trade organizations to engage in required contracts regarding activities such as supply of goods, sales, maximum price standards, specification, productions of goods, imports, storage, distribution, transportation, marketing and labeling and under these circumstances establish the required rules and regulations to secure the consumer
    eg. Display of Price board, issue of bills of sales
  - Properly inspect whether the factors such as required nutritional value of a food product, suitability of packaging, production standards are in line with the organizational standard and criteria and is of a satisfactory Quality, a Certificate is issued for the product
  - The mark of the relevant Quality Certificate can be displayed on the container
  - There is a standard procedure for assigning of standerd number
    eg. SLS 183
  - Consumer Protection is confirmed by this practice
- Suitability of a food product for consumption depends on the security of the product. Therefore packaging is very important in food production
- Packaging is a combination of Technique, Science and art used for the distribution and sale of products
- Wrapping of food product or putting into a container and offering same to the customer is referred to as packaging
- Relevant rules and regulations for packaging is imposed under the, food act, and consumer authority act for the purpose of consumer security
- Standards related to packaging has been published by the standards institute
- Packaging is important for the following reasons
  - To secure food product
  - Facilitate transportation and storage
  - To protect the quality of food
  - Uniformity and easy distribution
  - Easy handling

- Improve the appearance of the product and consumer attraction
- Packaging is a successful advertising media

- Different types of packaging are listed below while environmental friendly packaging are more suitable
  - Primary Packaging - Packaging that directly touches the product
  - Secondary Packaging - Packaging which facilitates transportation and handling (second packaging)
  - Consumer Packaging - the Packaging of the product at the point of at the point of its being handed over to the consumer
  - Transportation Packaging - A packaging design for Transport of Associated Products or a Single Product
  - Vacuumed Packaging - Packaging for dried fruits, sausages, meat balls etc.
- Packaging material should have the following features
  - Toxin free and suits intended product
  - Should be Hygienic
  - Resistant to moisture and oil
  - Resists to gas and smell
  - Resists shocks
  - Transparency and facility to open
  - Facility to take goods out and re close
  - Heat resistant
  - Ability to print over
  - Attraction and low cost
- Paper, Plastic sheets, metal containers, Bottles, Wooden and Hard board boxes are used for packaging
- Packaging material can be categorize according to the nature
  - Rough/Hard Packaging - Glass
  - Semi Rough/Hard Packaging - Aluminum, Plastic, Hard board
  - Flexible Packaging - Aluminum Paper and Wrapping, Plastic, Polypropylene
- Labeling is important to provide clear understanding of the product to the consumer
- When a product is introducing to the market and advertised, it is essential to follow up rules and regulations of the food act

- If anybody failed to label the container, or packaging according to the rules and regulations imposed by the act, such products must not be sold, introduced to the market or displayed
- The following facts should be included on a label
  - Main Frame
    - Common name
    - Trade name
    - Net weight
      Solid - g/kg
      Liquid - ml/l
      if it is in liquid form net weight without water - g/kg
- In addition to above following information should included
  - Permitted additives by name or under international coding system (INS - International Numbering System)
  - Instruction for storage and handling
  - Name and address of manufacture
  - Name and address of packer or distributor within Sri Lanka
  - Batch Number, Code Number or bar-code indicator
  - Date of manufacture and Date of expiry should be indicated as follows DD/MM/YY or YY/MM/DD
  - When product is imported in bulk and re-packed, Date of manufacture and Date of re-packing should be indicated
  - Food components and amounts in descending order
  - Country of origin (country name which imported food produced)
  - Other statements under the act
  - If the Product is under a Quality Standard, Nothing other than the Components declared by the Quality Standard can be added
  - If imported food has undergone radiation treatment, the label should carry an indication of same and relevant International Code Number
  - A product that has undergone genetic modification should obtain approval from the authority of food
  - Method of handling and storage of the product
- The following advantages can be acquired by labeling
  - ability to identify expired and non standard products
  - ability to select food to meet one's appetite and requirements
  - to prevent entry of unsuitable products to the market

- To improve exact technical features of a product, external inputs added on to the product in food processing is referred to as additives
  - Vitamins and mineral salts
  - Flavour such as natural plant material and spices
  - Part of flowers and salt
  - Yeast/ yeast extracts
  - All types of proteins attacked by hydrolization or self deterioration
  - Starter innoculants
  - Malt or malt extracts
- Food addictives can be categorised as follows
  - colourings
  - preservatives
  - anti-oxidisidents
  - emulsifiers
  - thickeners
  - flvours & flavour enhancers
  - acids and acidity regulators
  - modified starch
  - anticaking agents
  - antiforming agents
  - firming agents
  - enzymes
- Colouring agents are a decisional factor for attracting the consumer
- Among the 2000 nos of artificial colouring, there are only ten permitted for food
- Carmosine
- Fast red E
- Ponceau 4R

} Red

- Indigo-carmine
- Brilliant Blue FCF

} Blue

- Tatrazine
- Amaranth
- Sunset Yellow

} Yellow

- Green S
- Green FCF

} Green

- Since artificial colourings can be carcinogenic, it is prohibited to add them to certain food products

  eg. Fish, Fruits, Coffee, Tea powder, Butter

- Recommended colourings can be identified by means of the number given under E grade
  eg. E_{100} - Curcumin - margarine
  E_{22} - Carmoisine - Jam
- The agents which prevent the growth of Bacteria, Yeast and fungi in food products are referred to as preservatives
- The common preservatives can be categorized into 7 groups and these are as follows
- Sorbates, Bensoates, Sulphite, Biphenyl, Amenes, Nitrates, Propunates
- Since Flavours and Preservatives are chemicals, over consumption leads to health problems such as lung cancer and disorders of the excretory system
- Through the introduction of consumption limitations and status, Health Problems can be minimized
- These can vary according to the country and time duration
- Preservatives vary according to variety of food
  eg. Fruit Juice - Bensoic Acid
- Foods that consist of oil and fat are subjected to oxidation utilizing oxygen in the atmosphere
- Oxidization can be prevented by means of anti-oxidize agents
- Certain foods are rich in natural antioxidants agents
  eg. Vitamin C, E - Amino acids consist of sulphur
- Oxidization leads to reduction of taste and nutritional value of the food
  eg. rancidity, softing, browning
- There are substances which are not anti is oxidant but prevent oxidation
  eg. Citric acid, Phosphoric acid and its derivatives
- Component or set of components which generate a sign of taste are referred to as Flavours
- Appetite and attraction of the food product can be improved by the same
- There are seven flavours in food and they consist of different chemicals
  - compharaceous
  - musky
  - floral
  - peperminty
  - ethereal
  - pungent
  - putrid
- All Flavours are aromatic combinations and influence taste and smell of the food

- These can be categorized according to source
  - Obtained from natural plant material
  - Flavour obtained by distillation or pressing of natural plant parts
  - Produced artificial chemical compounds equivalent to Natural Chemical Compounds
  - Compounds extracted from natural media or extracted from pure chemical compounds
- In addition to these there are agents which can't flavour food directly by strengthening the Natural Taste, these are referred to as or flavour enhancers

  eg. Mono Sodium Glutamate (M.S.G.), Ibotenic acid, Inosinc 5 Mano Phosphate (IMP)
- These are carcinogenic and consumption over dosage leads to toxic and side effects
- The above mentioned standards relate to Food Production, and Food related activities, describe regulations in relation to quality requirements of food product in the Sri Lankan market, security, composition and packaging should be in line with identified levels and describe the regulation regarding labeling requirements
- Anybody, who produces foods, Imports, Distributes, or sells in Sri Lanka is subject to follow these rules and regulations

Competency level 15.6 : Decides on solutions to nutritional problems

Duration : 04 periods.

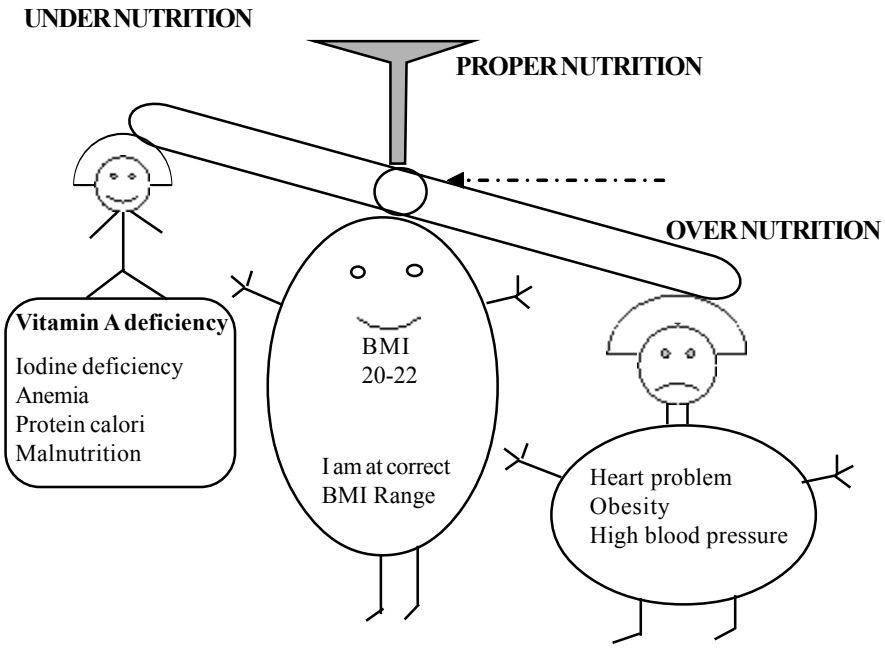
Learning outcomes :

- Explains the situation created as a result of improper nutrition.
- Names the common nutritional deficiency situation in Sri Lanka.
- Prepares plans to minimize nutritional problem.
- Selects food products minimizing nutritional problems.
- States that, certain diseased situation can be prevented through proper nutrition.

Teaching-learning process:

Engagement :

- Present the following poster to the class.



- Inquire from students regarding correct nutrition and malnutrition.
- Conduct a discussion highlighting the following points,
  - Intake of nutritions is less or in excess than the requirement does not meet good nutrition it is called an malnutrition
  - Through Proper Nutrition, health problems can be minimized
  - The BM"I indicates that weight relation to hight with physical well being

Proposed instructions for learning:

- Explore the activity assigned to you from the topics listed below regarding nutrition problems
  - Under-nutrition
  - Over-nutrition
- Define malnutrition and name the factors that effect good health conditions of a person.
- Define malnutrition status related to your topic.
- Identify the potential people for the same.
- Identify the common malnutrition status found in Sri Lanka relevant to your topic.
- Describe the impact of mal-nutrition status mentioned by you for a healthy life.
- Describe how to prevent the above mal-nutrition status or problems.
- Find out the (BMI) body man index of your team members.
- Describe the importance of BMI value for proper nutrition.
- Present the nutrient component requirement relevant to your age group using the RDI table. (Recommended Dietary intake)
- Prepare to present your finding to the whole class.

Guidelines to the explanation of subject matter:

- Conduct a discussion highlighting the following points
  That,
  - The health condition of a person is determined by factors such as male/female, age, physical condition, and the food consumed.
  - mal-nutrition is improper nutrition.
  - when food consume by a person consists of either excessive essential nutrients or less than the requirement they create mal-nutritional conditions.
  - There are two types of mal nutrition
    - Under - nourishment/ Under nutrition
    - Over - nourishment/ Over nutrition
  - Infants, Children, Pregnant mothers, feeding mothers, infected or patients are more susceptible to mal-nutrition
  - People who eat oil rich food, instant food, and have little exercises and the younger generation is more susceptible to over-nutrition
  - The result of not getting either one or all of the essential nutrients that leads to bad health conditions is referred to as under-nutrition
  - The condition resulting from over-consumption of food is referred to as over nutrition

- Protein calorie mal-nutrition, deficiency of Vitamin A, deficiency of Iodine, deficiently of Iron, Fluorides are under-nutrient conditions found in a small scale in Sri Lanka
- As a result of protein energy mal nutrition over a long period failure to provide the required protein, carbohydrates, and fat and, body used adjustment to adjust to the situation, leads to emaciation, loss of body weight and stunting.
- Protein energy malnutrition leads to situations such as Marasmus, Kwashiorkor
- Proper nutrition will avert such situations
- Reduction of growth, emaciation, Swollen abdomen are symptoms of Marasmus
- Loss of bodyweight, Reduction of growth, oedema (swelling of the body tissues) are symptoms of Kwashiorkor
- Vitamin A is a micro-nutrient essential for various functions of the body and deficiency of the same leads to, Blindness xerophthalmia and skin problems
- Consumption of vitamin A rich food, application of correct food preparation methods, help to avert the situation
- Iodine is also a micro nutrient and deficiency of same leads to abortion, dead birth of infants, and goitre
- Deficiency of Iron leads to nutrition anemia, fatigue/fixed and reduction of Heart beat and inefficient beat are symptoms of same
- Provision of daily requirements of Iron and preparation of food in such away as to facilitate absorption of iron helps minimize this deficiency
- Over nutrition leads to obesity, Diabetes, High blood pressure and heart problems
- Use of proper nutrition and exercise helps prevent such situations
- Recommended nutrient values for Sri Lanka are included in the RDI (Recommended Dietary Intake) for attention
- BMI, Body mass index is important to ensure physical wellbeing
- Actual value falls under the lower value of optimum range referred to as mal-nutrition and when the actual value above the higher value of the optimum range is referred as over-nutrition and appropriate steps have to be taken accordingly

Competency 16.0 : Exhibits readiness to engage in agricultural activities minimizing environmental impact.

Competency level 16.1 : Plans to avoid environmentaly hazardous activities related to agriculture.

Duration : 04 periods.

Learning outcomes :

- States that environmental pollution can take place under various circumstances in agriculture.
- Names agricultural activities which adversely affect the environment.
- Describes the adverse effects on the environment by disorderly and unsuitable agricultural practices.
- Describes how to carry out environment friendly cultivation.
- Proposes methodologies to minimize environmental Hazards caused by agricultural practices.

Teaching-learning process:

Engagement :

- Present a picture that consists of either unsystematic or unsuitable practices in agriculture or a disaster caused by same.
- Conduct a discussion highlighting the following points in relation to the picture.
  - There are bad practices in agriculture as a result of commercialization and urbanization
- There is a bad impact on the environment due to harmful practices in agriculture.
- There are various methods to overcome this situations

Proposed instructions for learning:

- Focus your attention on the adverse impacts caused by agricultural activities as listed below.

Group I	Group II
• Usage of unsuitable methods for land preparation • Improper usage of fertilizer • Unsystematic pesticide application	• Improper water management • Improper disposal of wastage • Non application of c farming systems and cropping patterns

- Discuss the topic assigned to you with your group.
- Describe the adverse impacts made by the topics assign for you.
- Describe the preventive action that can be taken to avoid these impacts
- Design a posters to convey the message
- Present you finding to the whole class.

Guidelines to the explanation of subject matter:

- Conduct a discussion highlighting the following points.
- Improper agricultural activities result in Air Pollution, Bio Pollution underground water pollution and surface water pollution
- Failure to select crops suit to the land, results soil erosion
  eg. Steepy land
- Removing soil cover and using of wrong equipment and inproper land preparation results soil erosion
- As a result of not following soil conservation methods, soil erosion takes place
- As a result of the failure to identify the deficiencies and failure to apply required fertilizer leads to the following affects
  - Excess Nitrates, Phosphates, and Sulphate accumulate in rivers, brooks and brooklets and pollute the surface and underground water
  - Animals and humans are subject to diseases
  - Disturbances to Hydrolic, Carbon and Oxygen cycles
- Excessive and non formal usage of pesticides and weedicides lead to the following damage
  - effects muscular growth and respiration of insects
  - liable to cause diseases and destriction of useful animals
  - mutation in plants
  - breakdown of food chain
  - pollution of soil and water
- Disorders in disposal of waste results in water and air pollution
  eg. Contamination by urine and dung
- Improper irrigation systems, and lack of maintenance of drainage systems leads to environmental pollution
- As a result of not failure to apply cropping systems and cropping patterns leads to environmental pollution
- To minimize environmental pollution made by adverse agricultural practices, the following steps can be applied
  - Apply improved soil conservation system

(eg. Salt (slopy agricultural land technique), contour bunds, stone bunds
    - Usage of suitable cropping systems and cropping patterns
    - Integration of crop cultivation and animal husbandry
- Usage of Organic fertilizer
    - application of green manure
    - biological nitrogen fixation by means of pulse crops
    - usage of crop residues as litter (stubble)
    - usage of compost
    - usage of animal manure
    - usage of wormy compost
- Selecting of local crop varieties and carrying out breeding programmes
- Cultivation of crops which are suitable for the area and are resistant to pests and diseases
- Usage of improved low-cost and with low labour consumption requirement, equipments from the point of land preparation and to the point harvesting
- Control of pests, diseases and weeds by using local biological methods
- Usage of integrated pest management system

Competency level 16.2 : Plans ecofriendly cropping systems and cropping patterns

Duration : 05 periods.

Learning outcomes :

- Describes various cropping systems and cropping patterns.
- Describes that cropping systems and cropping patterns can be applied without damaging the environment.
- Describes the advantages and disadvantages of each system.
- Studies and names the cropping systems and cropping patterns used in the school garden and others in the area.
- Describes the possibility of increasing harvest per unit area by applying various cropping patterns.

Teaching-learning process:

Engagement :

- Present a photograph of a chena cultivation.
- Let students study the photograph.
- Conduct a discussion highlighting undermentioned points.
  That,
  - Chena cultivation is a conventional cropping system in Sri Lanka.
  - Other than chena cultivation there are other cropping systems
  - Dry farming
  - Integrated farming system
  - Conservative farming
  - There are various cropping patterns within a cropping system
    - Crop rotation
    - Inter cropping
    - Mixed cropping
    - Relay cropping
    - Animal crop rotation
  - Cropping systems and cropping patterns should be used to increase harvest per unit area

Proposed instructions for learning:

- Focus your attention on the topic assigned to your group regarding cropping systems and cropping patterns.

Group 1	Group 2	Group 3
• Chena cultivation • Dry farming • Crop rotation	• Integrated farming • Animal crop rotation • Relay cropping	• Conservation farming • Inter cropping • Mix cropping

- Use the resource book.
- Identify the cropping system and cropping pattern assigned to your group.
- Describe the application of the cropping system and cropping patterns assigned to you.
- Name the crop/crop groups which can be cultivated under the said cropping system and cropping pattern.
- Discuss the advantages and disadvantages of these.
- Collect information about the places, either in your school garden or any other place in your area, where the cropping system and cropping patterns are in use.
- Prepare to present your findings to the class.

Guidelines to the explanation of subject matter:

- Conduct a discussion highlighting the following points.
  That,
  - Chena cultivation is a conventional cultivation practices mainly used in the dry zone in Sri Lanka using only rain water
  - Shifting of land in practice
  - There are various steps in chena cultivation
    - land clearance
    - burning
    - fencing
  - Short term crops such as upland rice and maize is cultivated in chenas
  - There are advantages and disadvantages in chena cultivations
  - Areas where the annual rainfall is less than 508 mm, cultivation done using the scantly available water effectively is referred as dry farming
  - Principles of dry farming are applied in Sri Lanka for cultivation
  - there should be a system to retain rain water in this practice
  - There are various methods for same
    - adding of organic matter
    - mulching of soil
  - In dry farming from the point of land preparation to harvesting, in each step necessary measures have to be taken for water conservation

- There are advantages and disadvantages in dry farming
- Contribution of byproducts as raw-material for another product and exchange benefits among Crop production Animal husbandry and Power Generation in one single location is referred to as the integrated farming system.
- There are various units under the integrated farming system
  - Crop cultivation
  - Power generation
  - Animal husbandry
  - Pasture cultivation
- There are advantages and disadvantages in the integrated farming system
- Usage of suitable strategies to conserve soil, water and nutrients, in sustainable crop cultivation by securing bio diversity referred to as conservation farming
- There are various steps followed to conserve organisms, water and soil
- There are sub units in conservation farming
  - Agro forestry (Silvi culture)
  - Crop stubble and mulching systems
- There are advantages in Agro forestry
- In alley cropping selected tree crops are planted along the alleys and the intended crops are planted between the ally ways
- There are advantages is alley cropping
- Diversification of agro forestry has become a multiple level cropping system
- Kandiyan Homegardesns are an example of the multiple layer cropping system
- Water and soil conservation can be done by applying crop stubbles and mulching
- In addition to the original crop cultivated in a field crop or crops cultivated without disturbing the original crop is referred to as intercultivation
- There are various advantages and disadvantages
- Cultivation of annual, biannual and perennial crops in a block of land, without creating a competition between the categories with equal care to maximize the level of utilization is referred as mixed cropping
- In chena cultivation, and Kandyan home garden, mixed cropping is applied
- Various factors have to be considered when selecting crops for mixed cropping
- There are advantages and disadvantages in mixed cropping
- When a crop ends its vegetative growth stage and reach the re-producing stage, cultivation of another crop in the same place is referred to as relay - cropping
- There are various advantages and disadvantage in this system
- A set of identified crops cultivated systematically in a field, changing seasonally is referred as crop rotation

- There is an importance in crop rotation
- There are various factors to be considered in the selection of crops for crop-rotation
- There are various factors to be considered in the selection of crops for crop rotation
- Seasonal cultivation of crops and the use of animals in one particular field in rotation systems referred to as animal crop rotation
- In this, method, the field divided into three sections for, crop cultivation, rearing of animals and cultivation of pasture
- There are advantages in the animal crop rotation system

Competency 17.0 : Plans to apply principles of economics to improve productivity in agricultural business.

Competency level 17.1 : Inquires about management of production factors.

Duration : 03periods.

Learning outcomes :

- List outs production factors, highlight characteristics of each, and build up definitions.
- Describe how to manage production factors effectively and in a productive manner,.
- Above management practices for the selection of the land.
- Highlight the features related to the concepts and build up definitions.
- Focus on efficiency and productivity.

Dialogue between three students

Kamal : We have to have a small farm garden in the school. First of all we have to find a place but there are buildings are all over.

Piyal : Why don't we use the space available behind the library.

Nimal : OK. Then what about mamoties, knives, rakes etc.

Piyal : Why, these are available in the agriculture room.

Nimal : OK. Then what about seeds, manure and agro chemicals.

Kamal : We have some savings with the Sir and let's ask for it.

Piyal : OK. We are here to work. We can get instructions from the sir and required labour from the others in the class.

Nimal : Yes. Lets start tomorrow.

Teaching-learning process:

Engagement :

- Present the following dialogue using a few volunteers in drama form.
- Conduct a discussion highlighting the following points
  - There are various materials required whatever inputs are required carrying out the production process is referred to as production factors.
  - Factors required for production can be categoriesed under four categories.
  - These can be introduced as land capital, labour, and entrepreneurship.

Proposed instructions for learning:

- Focus your attention on the set of production factors assigned to you among the sets listed below
  - land and capital
  - labour and entrepreneurship
- Highlight the definitions of the production factors assigned to you using the resource book.
- List out the characteristics of each production factor.
- Identify the ways and means of management of production factors using the resource book.
- In the process of preparing the school farm, describe the management applications input to enhance optimum productivity of given production factors.
- Prepare to present your findings to the whole class.

Guidelines to the explanation of subject matter:

- Conduct a discussion highlighting the following points.
  That,
  - The Production factors, Land capital, Labour and entrepreneurship are essential for any Production Process.
  - Production factors can be categorised into two, such as flow resources and stock resources.
  - The resources which are not utilized immediately and are not available for the future is referred to as flow resources.
    eg. labour
  - The resources which are not used immediately can be stored and utilized in future are referred to as stock resource.
    eg. capital

- The production process is managed under two time ranges
- These are called Short-run and Long-run
- In the short-run, Production, the factors which can change (add or decrease) are defined as variable factors
  eg. labour (untrained)
- In the short run the factors which are not changed are defined as fixed assests
  eg. land and machinery
- Land is a natural resource, it consist of resources which cannot be made by human beings and contribute to production
- The total economic process of a country depends on the factor of land
- There are specific features of land
  eg. It is granted by nature
  Homogeneous factor
- Land is an important factor in agriculture
- There are various factors that effect the productivity of land
- Productivity of land can be improved by the application of various methods
  eg.
  - According to the location of the land employee in suitable production process
  - Soil composition, climatic factors are also to be considered
- Physical or mental effort input for a production or service referred to as labour
- There are special features of the labour factor
  eg. Labour cannot be separated from the labourer. It is a flow resource. Its not homogeneous
- People involved in certain productions and vocations and are settled in specific areas is referred to as regional specialization
- Labour of a high standard value is treated as labour capital
- Various methods can be applied to improve labour productivity
  eg. Concern about the quality of labour, Introduce labour sensitive industries where labour is freely available, high salary for skilled labour, unskilled labour is use only when required
- Physical division of labour is referred activities involved in the production process divided among various labour catagories
- Capital expenditure is a value contribute for the production process, made by Human beings
- Capital is an important production factor

- Capital is used to purchase machinery, equipment and Raw material required for production
- Productivity of capital can be improved by means of various methods
  eg. Proper Planning of the Production Process
  Proper management of production factors
- Entrepreneurship is a process of organising a production process
- Entrepreneurship is also a Human Resource
- Entrepreneurship has special characters
  eg. Bearing risk, Forecasting, Commitment and enthusiasm
- Function of Entrepreneurship can be improved by various means
  eg. Help improve relevant knowledge and get benefits sent the function
- Productivity of agricultural business can be improved by managing production factors effectively

Competency level 17.2 : Analyses the demand pattern of agricultural products based on the utility theory.

Duration : 04 periods.

Learning outcomes :

- Explains the theory of utility by mean of cardinal utility and ordinal utility.
- Illustrated graphically, utility and marginal utility of product consumption.
- Defines marginal utility and marginal utility theory and derives demand and draws the demand curves.
- Explain the behaviours of a person who consumes more than one product to suit the personal income and to reach maximum satisfaction.
- Matches expenses suit income and satisfy needs and wants.

Teaching-learning process:

Engagement :

- Read the following incidents to the class.

Case Study I - Small Sameera is fond of ice-cream. His father gave him 100 Rupees. He liked ice-cream so much that he wanted to spend the entire 100 Rupees on ice-cream. He bought one for Rs. 20 and ate it. Again he bought a another one using Rs. 20/- . Once he ate the second one, he needed no more ice cream. Though he came with high hopes, two ice-cream satisfied his desired.

Case Study II- Amal and Kamal are engaged in work on the school garden. Around 10.00 O'clock they went to the canteen since they were hungry. They had only 20 Rupees. Though they wanted to eat 02 buns, looking at the price list they happened to limit themselves to two waddeys and a plain tea.

- Conduct a discussion highlighting following points
- Consumption of a Product generates a satisfaction through utility
- Continuation of consumption of particular products reduces utility
- Willingness is adequate to buy a product for consumption.
- To suit their personal income, people assess logically and fulfill various requirements.

Proposed instructions for learning:

- Select the table assigned to you from the tables given below.

Table I

No of Buns consume	Total utility	Marginal utility
1	20	.....
2	34	.....
3	46	.....
4	54	.....
5	58	.....
6	58	.....
7	54	.....

Table II

No of team consume	Total utility	Marginal utility
1	18	.....
2	34	.....
3	44	.....
4	52	.....
5	58	.....
6	58	.....
7	37	.....

- Provide answers for the following questions using the resource book.
  - Using the table assigned fo you, calculate the number of items consumed and marginal utility.
  - Using the data draw a graph to show the relation between consumption, total utility vs marginal utility.
  - Describe the relationship of consumption to total utility using the graph.
  - Describe the relationship of consumption to marginal utility using the graph.
  - Define marginal utility and the marginal utility theory.
  - Based on the theory prepare a demand table and draw a demand curve.
  - Name two conditions to be met by a person who consumes more products to maximize utility.
  - Prepare to present your findings to the whole class.

Guidelines to the explanation of subject matter:

- Conduct a discussion highlighting the following points
  - The market is the place where buyers and sellers meet to exchange their products or services
  - The behaviour of the consumers in the market creates a demand for products or services
  - Demand is a requirement created, based on the capacity to purchase
  - To describe customer behaviours economist put forward various views
  - These are describe in the cardinal utility and ordinal utility theories
  - The cardinal utility theory is referred to as marginal utility theory

- The satisfaction achieved by consuming a product or service can be measured numerically
- The total satisfaction achieved by consuming a product or service is defined as total utility
- The additional utility generated over the total utility by the consumption of and additional single unit is referred to as marginal utility
- Consumption of products and services increase total utility gradually and decreases marginal utility accordingly
- According to the law of marginal utility the consumer is achieved aquarium only when the price of the product is equal to the marginal utility
- Therefore, the customer demand curve and the marginal utility curve both behave the same
- As a result of diminishing marginal utility the demand curve declines gradually
- The following conditions should be satisfied by a consumer, who has a limited income and consumes various products, to maximize satisfaction within the income
    - Ratio between marginal utility and price of each product should be equal
    - The amount of money that can be spared for the product should be equal or less than his income
- Ordinal utility theory can be explained by means of indifference curve.

Competency level 17.3 : Plans to take decisions in terms of demand in Agriculture Production.

Duration : 04 periods.

Learning outcomes :

- Defines consumer demand.
- Names key factors that effect demand of a product.
- Describes the relationship between demand and price of a product.
- Describes the various strategies used to increase demand of a product.
- Describes the shifting of the demand curve as a result of factors other than price changing.
- Describes the nature of demand for agricultural products.

Teaching-learning process:

Engagement :

- Present a table to the class consisting of a few consumer products and their demand against price.

Marked price	Demand for Rice
Rs.	kg
40	100
50	900
60	800
70	700
80	600
90	500
100	400

- Inquire from students about the demand behaviour of a product, in relation to the price on the table.
- Inquire whether there are any other factors that influence demand other that price.
- Conduct a discussion highlighting the following

  That,

  - The price of the product has a major impact on the demand of a product
  - Apart from price, the following factors also influence the demand of a product

Price of substitutes/ complementary goods
Income of consumer
Consumer willingness

- Above factors that influence demand fluctuation

Proposed instructions for learning:

- Provide two tables that consist of various products and their demand under various prices, to two teams. It is important to ensure the products should conform to the demand theory.

Demand Table (1) **Demand Table (2)**

- Focus your attention on the demand table assigned to you and explore same under the following themes.
- Use the resource book.
- Define consumer demand of a product using the demand table given
- Build up a demand curve, using price of product and related demand volumes in the table given
- Study demand behaviour, against increase or decrease of price of the product
- Look for any other factors that effect demand other than price and list out these
- Describe how these factors effect shifting of demand curve to the left and right
- Prepare to present your findings to the whole class.

Guidelines to the explanation of subject matter:

- Conduct a discussion highlighting the following points
  - Demand is the interest base on the purchasing power of a product.
  - Demand can be divided into two based on aim
  - Direct demand
  - In-direct demand
  - Apart from directly and indirectly derived, demand it can be divided further.
    - Joint demand/ Complementary demand
    - Composite demand
    - Price demand
    - Income demand
    - Cross demand
  - There are various factors effect that demand
    - Price of substitutes / complementory goods

  - Consumer's Income
  - Consumers willingness
- The list that indicates demand volumes under various price levels in the market, is called demand tables
- If the price and demand for a product maintains a negative relationship and it is in the imverse relationship, it can be converted into a graph and shown as a demand curve
- A demand curve maintains a slope
- A demand curve shrinks or expands depending on the price of the product
- When all the other factors remain unchanged the demand displays a inverse relationship or sensitivity to the price
- This sensitively varies according to the nature of the product
- The index used to measure this sensitivity is called the price elasticity of demand
- The value of elasticity behaves from 'o' to infinity and based on the values it is divided into five main catagories.
  - Perfectly inelastic – zero price elasticity and price changes does not lead to any change in quantity demanded
  - Inelastic – Demand elasticity is greater than 0 and less than 01
  - Uni-elasticity of demand – Demand elasticity is equal to 01 and changes in price resulting in exactly proportionate change in quantity
  - Elastic demand – value of demand elasticity is greater than 01 and less than infinity. Changes in price leads to a more than appropriate change in demand
  - Perfect elasticity demand – value of the elasticity is equal to infinity. Buyers buy all they can at the given price
- Effect of factors other than price shift to the demand curve to left and right
- Demand of agricultural products are perfectly elastic in general

Competency level 17.4 : Plans to take necessary decisions to suit supply situations in agricultural enterprises.

Duration : 05 periods.

Learning outcomes :

- Defines market supply.
- Name factors that effect the supply of a product.
- Explains the relationship between price and supply.
- Describes the supply table and supply curves.
- Describe the reasons for shifting of the supply curve.
- Describe the nature of supply of agricultural products.

Teaching-learning process:

Engagement :

- Present the following drama to the class.

Case presentation		
Father	:	Son, our field is very fertile this time. It is the right time for harvesting.
Son	:	That's right, I saw that Sunil's field is also well fertile.
Father	:	We got the fertilizer subsidy this time and rice price will go down, this time.
Son	:	So, what we can do is, sell a part now and sell the rest later on.

- Present the above dialogue dramatically to the class by using prepared two students.
- Relevant to the dialogue conduct a discussion highlighting following points
- Farmers supply their excess production to the market
- Thus the provision of products to the market is defined as supply
- Provision of fertilizer subsidy or any other motivation leads to increase in supply to the market
- There is a relationship between the current price and supply.

Proposed instructions for learning:

- Two supply lists consist of the price and relative supply, of potato and tomato are given below. Select the relevant supply for your team.

Supply Table 1

Price/kg	Supply /kg
100	1000
90	900
80	800
70	700
60	600
50	500
40	400
30	300
20	200
10	100

Supply Table 2

Price /kg	Supply/kg
10	1
20	2
30	3
40	4
50	5
60	6
70	7
80	8
90	9
100	10

- Use the resource book and answer the following questions.
- Define the product supply to the market
- Build up the supply curve between price and quantity of supply of the product or goods.
- Describe the supply curve's behaviour based on the market price fluctuation.
- Find the factors that effect the supply, other than price in the market and list out them.
- Describe the changes in the supply curve, according to those factors.
- Describe the reasons for perfect inelasticity of supply for agricultural products.
- Prepare to present your findings to the whole class.

Guidelines to the explanation of subject matter:

- Conduct a discussion highlighting following.

  That,

  - The amount of goods offered to the market for sale over a specific period under a specific price is referred to as supply of that product
  - The total supply made by various suppliers to a market is referred to as market supply
  - Supply can be expressed under supply table, supply function and a supply curve

- The table consist of quantity against prices to a product which is supposed to be sold by the supplier is referred as to the supply table
- The curve which indicates, the maximum product volumes that can be supplied is referred to as supply curve
- Supply functions explain the relationship between supply and the relative factors impact for supply numerically
- There are various factors that effect supply
- There is a direct relationship between price and quantity of supply
  eg.
  - Price of the product concerned
  - Technology used for production
  - Transportation and marketing facilities
  - Taxes and subsidies
  - Price of the alternative goods
  - Cost of imputs
- There is a direct relationshio between price and quantity os supply
- Price changes of the product concerned leads the supply curce to either shrink or expand
- Factors other than the price which affect the supply leads to a shift in the supply curve
- When, the price of production factors is low, improvement of technology or production favourable climate conditions and subsidies are available the supply curve would shift to the right side
- When the price of the production factors increase due to drought and floods and addition taxes imposed, leads to the shifting of demand sypply curve to left side
- Demand sensitivity according to the changes of price is referred to as supply elasticity of price
- Just like the demand elasticity of price, supply elasticity of price can also be divided into 5 categories as follow
  Perfectly inelastic, Inelastic, Unit elastic, Elastic and Perfectly elastic
- Agricultural products carry a perfectly inelastic supply.

Competency level 17.5 : Plans to make decisions in agriculture enterprises, by studying market conditions.

Duration : 03 periods.

Learning outcomes :

- Defines the market.
- Expresses that all market structures are working towards profit maximization.
- Classifies market structures according to various characteristics.
- Describes that in the perfect competitive market the determination of price is based on demand and supply.
- Compares the features of a perfectly competitive market and a monopoly market.

Teaching-learning process:

Engagement :

- Present a dialogue in dramatic form using students to the class regarding market structures with the simple knowledge available.
- Script has to designed in such a way as to highlight features of a perfect competitive market and monopoly market simply and limit it to a short length of 10 minutes.
- If not, present a newspaper report regarding market status, or any other suitable news to the class using a selected students.
- Inquires from students about the market conditions described in the dialogue or the report.
- Conduct a discussion highlighting the following points.
  That,
  - There are various types of markets
  - In the market there are two extremes such as monopoly and perfect competition
  - Buyers and sellers do meet in the market
  - Market activities are there to maximize profit

Proposed instructions for learning:

- Focus your attention on the topic assigned to you.
  - Perfect competition market.
  - Monopoly market.
- Use the information competition and answer the following questions
  - explain the characteristics of markets
  - describe the mechanism of price determination

- what is the nature of the demand curve?
- Explain the following external factors that influence the changing market equilibrium
  - government involvement
  - Impact of different markets
  - Prepare to present your finding to the whole class

Guidelines to the explanation of subject matter:

- Conduct a discussion highlighting the following.
  - A market is the place where buyers and sellers meet to exchange their products and services
  - Based on the various features market has two extremes such as perfect competition and monopoly market
  - In the perfectly competitive market an equilibrium price & quantity is determined where the supply and demand is equal
  - In a monopoly market the supplier decides on the price and he can influence the price and service in the market
  - In a monopoly market, external factors also can influence the price
  - There are large numbers of buyers and sellers in a perfectly competitive market and in a monopoly market one supplier and a large number of buyers can be found
  - In perfect competition equal products are produced by a large number of manufactures and in a monopoly market there is not equalents or substitute to their products
  - In perfect competitive market there is complete freedom of entry into and exit from the market but it is not possible for an entirely newcomer in the monopoly market
  - There are a large number of small business enterprises in a perfect competitive market but the monopoly market consist of only one supplier
  - In the short run, firms will earn supernormal profits in a perfect competitive market and in a monopoly market supernormal profits can be earned in a short run as well as a long-run
  - Demand in a perfectly competitive market is perfectly elastic
  - The monopoly market price of the product varies according to production levels
  - The price of a product in a perfectly competitive market is equal to the average revenue and marginal revenue AR = MR

- The optimum behaviouring point of the market is its equilibrium
- When a business displays a great difference between total cost (TC) and Total Revenue (TR) it is at the equilibrium of profit maximization
- In a perfectly competitive market and a monopoly market, when marginal revenue (MR) equal to the marginal cost (MC) profits become maximum and establishes the market equilibrium

Competency level 17.6 : Display the readability of reduction cost in agricultural enterprises

Duration : 04 periods

Learning outcomes :

- Defines production cost.
- Describes the possibility of profit maximization through reduction of production costs in agricultural business.
- Describes the strategies applied to minimize production costs.
- Draws cost curves.
- Identifies the point that generates maximum profit.

Teaching-learning process:

Engagement :

- Present a cost report of an agricultural business to the class using a volunteer student.
- Inquire about the cost component in the report.
- Conduct a discussion highlighting the following points.
  - Production cost can be categorized.
  - There are various costs involved in business.
  - These can categorized as fixed cost and variable costs.
  - Profits can maximized by reduction of production cost.

Proposed instructions for learning:

- Provide detailed reports that consist of fixed costs and variable costs against each product produced in two different well-managed business enterprises in the same entity.

No. of Units Produce Q	Total Fixed Cost TFC Rs.	Total Variable Cost Rs.	Total Cost TC Rs.	Average Fixed Cost AFC Rs.	Total Variable Cost Rs.	Average Total Cost ATC Rs.	Marginal Cost MC Rs.
0	100	-					
1	100	130					
2	100	164					
3	100	201					
4	100	280					
5	100	470					
6	100	822					

No. of Units Produce Q	Total Fixed Cost TFC Rs.	Total Variable Cost Rs.	Total Cost TC Rs.	Average Fixed Cost AFC Rs.	Total Variable Cost Rs.	Average Total Cost ATC Rs.	Marginal Cost MC Rs.
0	150	-					
1	150	180					
2	150	220					
3	150	264					
4	150	364					
5	150	590					
6	150	1032					

- Focus your attention on the cost report of the agricultural business assigned to you and explore along the following themes
- Complete the table using the resource book
- Identify fixed cost and variable costs separately according to the cost report assigned to you
- Identify the nature of fixed cost and variable cost
- Define the total cost
- Build up cost curves of Total Fixed Cost (TFC), Total Variable Cost (TVC) and Total Cost (TC)
- Relevant to the given cost data Average Fixed Cost (AFC) = $\frac{TFC}{Q}$
  Q = Quantity
- Related to the given cost data calculate the Average Variable Cost (AVC) = $\frac{TVC}{Q}$
- Using the cost data calculate the Average Total Cost (ATC)
- Display Average Fixed Cost (AFC), Average Variable Cost (AVC) and Average Total Cost (ATC) using cost curves
- Describe the Marginal Cost concept (MC)
- Using total Cost (TC) or Total Variable Cost (TVC) prove that
  Marginal Cost = $\frac{\Delta TC}{\Delta Q}$ or $\frac{\Delta TVC}{\Delta Q}$
- Analysis the cost factors of Average Total Cost (ATC), Average Variable Cost, Average Fixed Cost (AFC) and Marginal Cost (MC) using the cost curves

Guidelines to the explanation of subject matter:

- Conduct a discussion highlighting following points
  - The costs involved in the production of goods or service is referred to as production cost
  - Factors that contribute to production such as unskilled labour, raw material which can change in the short run are referred to as variable factors
  - Factors which cannot change in the short run such as land, buildings and machinery are referred to as fixed factors
  - Production costs can be separated as short term and long term costs
  - In the short run organizations retain fixed assets constantly and change variable factors as required
  - In the long run, variable factors as well as fixed factors are changed to increase production.
  - Only when the production scale increased by means of volume increase in fixed assets and expansion is treated as production volume increase in an organization
  - In the short run cost can be divide into two as fixed costs and variable costs
    - The cost that does not change with the quantity of product (out put) is referred to as fixed cost
    - Cost changes relative to the quality of production is referred to as variable cost
  - The total of variable cost and fixed cost is referred to as total cost
  - Average variable cost per unit product

    $(AVC = \frac{TVC}{Q})$
  - Averaged fixed cost per unit product

    $(AFC = \frac{TFC}{Q})$
  - Average total cost per unit product

    $(ATC = \frac{TC}{Q})$

    In the production process, the cost involved to produce additional single

    product (Marginal Cost) $MC = \frac{\Delta TVC}{\Delta Q}$
  - There are strategies to minimize production costs
  - The point where Average Total Cost (ATC) is equal to Marginal Cost (MC), and the product process operates at optimum cost leads to maximize profitability

Competency level 17.7 : Describe the possibility of application of the production relationships to maximize profitability in agricultural activities.

Duration : 06 periods.

Learning outcomes :

- Defines production process.
- Expresses how to manage/organized production to optimize the profit in factor product relationship. (within 2nd production zonel)
- Plans for high production by converting fixed factors to variable factors in the long term.
- Expresses the determination of effective production combination in factor – factor relationship.
- Expresses the determination of effective production combination in product – product relationship.

Teaching-learning process:

Engagement :

- Present the following newspaper report to the class using a student.

Part of a newspaper report

Fertilized subsidies given this Maha season for paddy cultivation has increased yield to a certain extent, but it is not sufficient to cater to customer requirements. Therefore it is required as increase the land area by next season and increase the yield. Furthermore in the long term said the Minister of Agriculture.

Continuous increase of feed to cows alone won't help to increase milk production, therefore it is required to add concentrates to their feed ration as follows. Proper disease control method and treatment, provision of proper hygienic facilities in their sheds are the management practices which help to increase milk production, said on officer of the Department of Animal health and livestock.

- With reference to the above, conduct a discussion highlighting the following points.
  - Production is a process of converting inputs into a finished produce

- In the short term production process there are factors which can be changed based on urgent decisions
- These are referred to as variable factors
- The factors which cannot to changed in the short term are referred to as fixed factors
- These factors can be changed in the long term to increase production.

Proposed instructions for learning:

- Use the resource book and answer the following questions assigned to your group.
-

Group A

Factor - Product relationship

Group B

Factor - Factor relationship

Group C

Product - Product relationship

1. Identify the relationship assigned to your group.
2. Describe the principles which explains the relationship.
3. Describe the selection of optimum combination level in these relationships.

- Prepare to present your findings to the entire class.

Guidelines to the explanation of subject matter:

- Conduct a discussion highlighting the following points.
  - Production is a process of converting various resources into a product which can be either utilized directly or can be used as an input for any other process or as a service or changing a existing this
  - Resources in use are referred to as production factors or inputs and the output is referred to as finished product or production and this method is referred to as production technique
  - Production is a process of converting inputs or production factors such as land, labour, capital and entrepreneurship into a finished product such as a product or a service
  - Inputs required for a production process can be divided into fixed inputs and variable inputs/ factors
  - Input factors which can either increase or decrease based on urgency are referred to as variable factors in a production process

eg. Application of fertilizer in a field

- Those input factors which cannot be changed based on urgency are referred to as fixed inputs

  eg. Land area
- The production process can be either in the short run or the long run
- To increase variable input and run production while fixed inputs remain unchanged is referred to as short run in a business
- The period which changes both fixed and variable inputs in a business is referred to as the long run
- There are various relationships between inputs and outputs in agricultural production
- There are three main types of relationships as follows
  - factor - product relationship
  - factor - factor relationship
  - product - product relationship
- The relationship between a product and one variable factor is referred to as factor product relationship
- Economist have introduced the law of diminishing returns to explain factor product relatonship
- When equal units of a variable factor are added and other factors remain unchanged in a production process, then beyond a point, the returns to that factor or marginal production will begin to diminish, this is referred to as the law diminishing returns
- Using the total production in a production process, average production and marginal production can be obtained
- By using total production, marginal production and average production it is possible to draw the production curves for these
- The total production curve displays a rapid increase at the initial stage and starts to decline later on
- Any increase of output can be achieved up to the point of matching optimum employment of variables to fixed assets
- Once variable inputs meet the optimum level any other additional variables added won't contribute to the total production
- The marginal production curve increases around its initial stage and comes to maximum level before the total production curve, and starts to decline
- The marginal production curve declines through the maximum point of the average production curve

- Once total production is maximum marginal production becomes zero
- The declined zone of marginal three production is described the law of diminishing returns
- Production curves display production zones in short run production
- First production zone
  - The duration from zero production to the point where marginal production is equal to average production
  - At this production stage, by adding further inputs, production can be increased. Therefore the producer does not stop the production process at this stage
- Second production zone
  - The duration between when the average production is equal to marginal production, until total production becomes maximum
  - After reaching this stage total production and average production start to decline
  - Therefore, the manufacturer focuses moves on to profit in this area
- Third production zone
  - Total production is reduced and marginal production has a negative value
  - Since the total production is reducing no producer wants to reach this area
- The factor - factor relationship describes how a producer handles fixed and variable factors to maximize profit
- Isoquant curve and iso cost curve is used to explain the application
- The curve indicate various input combinations to achieve equal production is referred to as isoquant
- There are special features in isoquent curves

  eg.
  - Convex to the origin
  - Do not cross
  - Slope from left to right
- Slope of an isoquant is referred to as marginal rate of substitution
- This describes the possibility of substitution of two production factors
- If a producer utilizes the full amount of money, income to buy a product, the amount of goods can be bought marked on the Y axis of a graph and if he uses the same amount of money to buy any other product, the amount of goods can be bought marks on 'X' axis of the graph. Once these two points are linked the iso revenue line is created
- The point where the isoquant touches the iso revenue line describes the best input combination which maximize profitability

- A producer can employ his assistents in various manners
- The factor - factor relationship explains how to select optimum combinations to maximize profitability
- When a decision made about a product over two or more alternatives the cost of the lost alternative is referred to as opportunity cost
- When a decision is made for a product over two or more alternatives the cost of the lost alternative is referred to as opportunity cost
- Using resources and technology with a supplier the product combination that can be produced illustrated by the production possibility curve
- Among the products, manufactured by a producer, the combination of which can be produced at maximum level is illustrated by the iso revenue line
- The point where the Production Possibility curve crosses the iso revenue line. The curve highlights the best production combination to maximize profitability

Competency level 17.8 : Maintain records to run an agricultural business systematically.

Duration : 05 periods.

Learning outcomes :

- Define agricultural farm records.
- Divides agricultural farm records into its main categories.
- Describes the importance of maintaining records.
- Categories finance records.
- Describes the importance of proper structures in agricultural reports.

Teaching-learning process:

Engagement :

- Hand over various models of farm records to students and let them observe and read.
- Inquire from students about reporting structure and details.
- Conduct a discussion highlighting the following points.
  - Various records have to be maintained in Agricultural business.
  - These records can be divided into two main categories such as financial and physical reports.
  - Agricultural farm reports are important for effective management.

Proposed instructions for learning:

- The following are the two main record types maintained in agricultural business
  - Financial reports
  - Physical reports (Farm Inventory/ Production reports)
- Focus your attention on one of the topics given above, and explore along the following themes,
  - Main Financial reports
    - Petty cash book
    - Cash book
    - Ledgers
    - Sales and loss and profit accounts
    - Balance sheet
  - Main Physical Reports
    - Land area detail of unused land areas
    - List of Raw material (Main Inventory)

- Machinery list/ details of buildings
- Weather reports
- Labour records
- Production records

- Use the resource book when required
- Study the structure of the model farm record given to you
- Observe the correct sequence of maintaining records/ notes, in the relevant model of reports. Highlight the importance of maintaining records in agricultural production enterprises according to the reports given to you
- Assume you are manager of an agricultural business, and discuss the impact of farm reports on management of agricultural business
- Present your findings to the whole class

Guidelines to the explanation of subject matter:

- Farm records and records which maintain accurate information available to take correct decisions in agricultural business.
- Farm records can be divided into two main categories as follows
  - Physical records
  - Finance records
- Objectives of maintaining farm records are as follows
  - To become aware of various production costs/ revenues devisionwise
  - To estimate cost/ profit devisionwise
  - Improve the effectiveness of inputs by means of evaluation of costs
  - To be aware of time bound inputs
  - To estimate existing financial and physical values assests and resources
  - To ascertain future loan requirements and when
  - For tax purposes
  - To minimise disposals
  - Run farm effectively for a long period
- Farm records support farm management as follows
  - To obtain information for future planning
  - To take short term and long term decisions
  - Decision making in resources allocation
  - To take decision on recruitments
  - To take decision related to the market
  - To decissions about new cultivation

- Financial information on agricultural businesses are included in finance records and these can be categorised as follows
  - Petty cash book
  - Cash book/ ledger
  - Trade and Loss/ Profit account
  - Balance sheet
- Important information in numbers rather than values are referred to a physical records.

  These are as follows
  - Land in use - unused land area
  - Inventory of material
  - Inventory of machinery
  - Inventory of buildings
  - Weather records
  - Labour records
- It is important to use correct model of forms and accurate recording system in agricultural recodt maintenance

Competency level 17.9 : Prepare a business plan for a small scale agricultural business enterprise.

Duration : 04 periods.

Learning outcomes :

- Define what an agricultural business is.
- Describe the business environment, when starting a small scale agricultural business enterprise.
- Introduces business resources required for agricultural businesses.
- Name the internal and external business ethics related to agricultural business.
- Preparing a project plan for a business.

Teaching-learning process:

Engagement :

- Present the following case to the class.

  Saman intends to produce mushrooms as a means of self employment. The initial money requirement to commence the business, was sourced by his father. When he started to harvest, he used to pack it into 100g packs and take to few boutiques closed by, for sale. The boutique owners refused to accept these for sale. The excuse given by them is that there were a few other suppliers who supplied the same. Therefore, his initial production was spoiled and he struggled to hunt for a market for his product.

- Referring to the above case-study, conduct a discussion highlighting the following points.
  - Production of mushrooms, nursery management and yoghurt production can be done as small scale agricultural business
  - Capital is required to start such a business
  - A business should be started with a proper plan
  - Business started with no plans faces various problem later on

Proposed instructions for learning:

- Select a topic from the topics listed below
  - A small scale Business related to animal Husbandry, A small scale business related to crop production

- Answer the following questions by referring to the resource book
- Describe the problems encountered by you in commencing and running a business along following themes
  - Business environment
  - Resources
  - Business ethics
- Describe the necessity of a business plan for your business
- Prepare a business plan for your business

Guidelines to the explanation of subject matter:

- Conduct a discussion highlighting the following points
  - Business is a combined efforts of activities organized towards the supply of a product or service
  - A business meant to supply an agricultural product or related service is referred to as an agricultural business

    eg. Production of mushrooms - Nursery management, Yoghurt production, Processing of food and re-packaging for sale
  - This type of business creates various opportunities

    eg. Generation of Job opportunities
    Provision of goods and service to the market
  - There are three factors that influence business
  - These are the business environment, resources and business ethics
  - The factors that influence internal and external activities are referred to as the business environment
  - This can be divided into two as the external and the internal environment
  - The investor on the business, managers, suppliers, customers, competitors, and employees are referred as Stakeholders of the business
  - For a successful business there should be committed managers and workers
  - The external environment of the business can divided into seven
    - Natural resources used and inputs for the business belongs to the natural environment and physical environmental factors are energy source etc.
    - Conditions of political rules and regulations of government and its policies directly influence the business
    - The population related to the data of a country is referred to as the social environment
    - The values of a society, habits and customs, social willingness, attitudes, behaviours and religious groups belong to the social environment

  - Commercial factors which effect business are referred to as the economic environment
  - Technology invented to carry out processes are refers as technical environment
  - The factors with a global effect which influence the business is the global environment
- Above mentioned 7 external factors affect even small scale agricultural businesses
- Resources required to commence a business and run it are referred to as business resources
- Land, labour availability, capital, raw material, technology and organizing skills are also considered as business resources
- Even small-scale businessmen have to have a better understand of these business resources
- Business management can be carried out using two technologies
  eg. Capital sensitive techniques, labour sensitive techniques
- Rather than the application of capital sensitive techniques which required more capital to the production process labour sensitive techniques, which employ more labour is more suitable to a country like Sri Lanka
- Most of the small-scale agricultural businesses, use labour available at family level and operate as one owner or joint business
- That the set of responsibilities a business is bound to conform to is called Business Ethics
- These can be divided as internal and external business ethics
- That the behaviour, speech honesty etc of the employees and management of a small scale business are its external ethic
- Ethics maintained with external parties is referred to as external ethics
  eg. Influence somebody else is employee too joint one's own business
- Production and supply of high quality products rather than focusing only on profitability is the social responsibility of the businessmen
- The document prepare to obtain loans (funds) for a new business or expansion of an existing business, which consist of an investment plan is referred to as the business plan
- To achieve identified objectives of businesses prepare business plans according
- A business plan results in various advantages to the businessmen and to the business
  eg. Organise the business systematically
- A business plan consists of four main parts

- These are, Technical plan, Human resource Management plan and market plan, Finance management plans
- Production and technical plan consist of the details of the production process
- Human resource management plan consists of details of labourers and helpers
- The market plans consist of details regarding marketing
- The finance resource plan consist of cost and revenue related details of the business
- A business plan prepared to be submitted to a bank for a loan (funds) should contain various information
  - business discription - market discription
- Enterprises which, produce, process, market or provide services of agriculture related product are, referred to as agricultural business

As producers - Vegetable and fruits, growers livestock manages, Aquaculturists and floricultures, Mushroom cultivators, Ornamental planters, Poultry managers

As processing institutes - Food, coconuts, tea, rubber, coir and other agricultural products related & processors

Marketing institutes - Rural and regional collectors, distributors, exporters, superior shops and brokers of market shops

Institutes which provide inputs - Produces and sells seeds, Agrochemicals, machinery, plants and planting materials

Institutes which supply services -

- Institutes of extension services
- Institution of financial and Institutions providing financial and credit facilities
- Institution providing financial and credit facilities

Competency level 17.10 : Plans for marketing process of agricultural products

Duration : 04 periods.

Learning outcomes :

- Describes marketing.
- Displays the steps of marketing.
- Describes the importance of efficiency in marketing.
- Describes the actions to be taken to improve efficiency in marketing.
- Draws required plans to achieve successful marketing process in agricultural products.

Teaching-learning process:

Engagement :

- Let a student read the following news paper report.

A part of a Newspaper report

The government has established regional economic centers at Dambulla, Meegoda and Veyangoda. As a result, the farmer who cultivates vegetables fruits and grains can direct their products to these centers without the involvement of intermediaries. Hence the farmer gets a better price for his product and the customer also can buy goods for a reasonable price. Government involvement in this has created an efficient marketing process in Agricultural Production.

- Referring to the above report, conduct a discussion highlighting following points.
  - The process of transmitting products, produced by farmers to the customer is referred to as marketing.
  - There are intermediaries involved in this process.
  - As intermediaries earn profit in the transaction, both producer and buyer loose profit.
  - This process can be done effectively with the involvement of the government.

Proposed instructions for learning:

- Answer the following questions assigned to you using the resource book.
- Prepare to present your findings to the whole class.
  - Group A
    Meat related products

- Group B
  Vegetable crop related products
- Group C
  Fruit crop related products

- Define marketing.
- Describe why the products assigned to you has special features of marketing.
- Describe the marketing process steps by steps of these products.
- Describe the physical activities involved in marketing these products.
- Describe the steps that have to be taken to improve efficiency in agricultural product marketing.
- Prepare to present your findings, to the whole class.

Guidelines to the explanation of subject matter:

- Conduct a discussion highlighting the following points
  That
  - Marketing is an integrated activity which satisfies human needs and wants through the achievement of business goals and objectives
  - Marketing of agricultural products is a special task
  - Marketing is a more extended task than selling of products
  - There are various reasons for the specialty
    eg. Majority of agricultural products are essential goods, supply of these products is seasonal. The short lifetime, (perishables), intermediaries have a greater price altering capacity than the farmer.
  - The agricultural production process starts from the farm gate and ends up with the consumer
  - Marketing can be categorized according to the number of steps involved
    eg. Direct sale from producer to consumer from producer through rural level collectors to consumer etc.
  - There are lots of intermediaries involved in certain marketing processes
  - An increase of number of intermediaries leads to an increased marketing cost and the resulting increase of retail price
  - Government involvement is required to minimize this situation and secure both producer and consumer
  - Government has already established regional and main economic centres for this purpose
  - Agricultural marketing consist of various functions

- These can be categorized as exchanges, physical activities and provision of services
- Both buying and selling belong exchange activities
- Storage, transportation, bearing risk and providing market information are physical activities.
- Standardization, financial facilities, bearing risks and supply of market information are facilitative activities
- Buying and selling are the main functions of marketing
- Most seasonal agricultural products can be stored under required stores conditions and by releasing to the market in deficiency helps to maintain price consistency of the product
- A efficient transportation mode makes marketing more efficient
- A high price can be gained from agricultural products by proper packing, sorting, proper handling and processing
- Supporting systems help effective exchange in agricultural product marketing
- Efficiency of agricultural marketing can be improved by maintaining required stock, use of suitable transportation, use of suitable packaging material, control methods of post and pre harvesting losses/ damage and advertising

SCHOOL BASED ASSESSMENT

Introduction- School Based Assessment

Learning –Teaching and Evaluation are three major components of the process of education. It is a fact that teachers should know that evaluation is used to assess the progress of learning – teaching process. Moreover, teachers should know that these components influence mutually and develop each other .According to formative assessment (continuous assessment) fundamentals, it should be done while teaching or it is an ongoing process. Formative assessment can be done at the beginning, in the middle, at the end and at any instance of the learning teaching process.

Teachers who expect to assess the progress of learning of the students should use an organized plan. School based assessment (SBA) process is not a mere examination method or a testing method. This programme is known as the method of intervening to develop learning in students and teaching of teachers. Furthermore, this process can be used to maximize the student's capacities by identifying their strengths and weaknesses closely.

When implementing SBA programmes, students are directed to exploratory process through learning teaching activities and it is expected that teachers should be with the students facilitating, directing and observing the task they are engaged in.

At this juncture students should be assessed continuously and the teacher should confirm whether the skills of the students get developed up to the expected level by assessing continuously. Learning teaching process should not only provide proper experiences to the students but also check whether the students have acquired them properly. For this to happen, proper guiding should be given.

Teachers who are engaged in evaluation (assessment) would be able to supply guidance in two ways. They are commonly known as feed-back and feed- forward. Teacher's role should be providing feedback to avoid learning difficulties when the students' weaknesses and inabilities are revealed and provide feed-forward when the abilities and the strengths are identified, to develop such strong skills of the students.

Student should be able to identify what objectives have been achieved to which level, leading to success of the learning teaching process. Teachers are expected to judge the competency levels of students have reached through evaluation and they should communicate information about student progress to parents and other relevant sectors. The best method that can be used to assess is the SBA that provides the opportunity to assess students continuously.

Teachers who have got the above objective in mind will use effective learning, teaching, evaluation methods to make the teaching process and learning process effective. Following are the types of evaluation tools student and, teachers can use. These types were introduced to teachers by the Department of Examination and National Institute of Education with the new reforms. Therefore, we expect that the teachers in the system know about them well

Types of assessment tools:

1.	Assignments	2.	Projects
3.	Survey	4.	Exploration
5.	Observation	6.	Exhibitions
7.	Field trips	8.	Short written tests
9.	Structured essays	10.	Open book test
11.	Creative activities	12.	Listening tests
13.	Practical work	14.	Speech
15.	Self -creations	16.	Group work
17.	Concept maps	18.	Double entry journal
19.	Wall papers	20.	Quizzes
21.	Question and answer book	22.	Debates
23.	Panel discussions	24.	Seminars
25.	Impromptu speeches	26.	Role-plays

Teachers are not expected to use above mentioned activities for all the units and for all the subjects. Teachers should be able to pick and choose the suitable type for the relevant units for the relevant subjects to assess the progress of the students appropriately. The types of assessment tools are mentioned in Teacher's Instructional Manuals.

If the teachers try to avoid administering the relevant assessment tools in their classes there will be lapses in exhibiting the growth of academic abilities, affective factors and psycho- motor skills in the students.

Proposed Teaching-Learning - Evaluation plan

1. Evaluation Term : 01

2. Competency levels covered : 11.1 to 11.3

3. Subject contents covered :
- Pest population levels
- Important pests in Agriculture
- Insects and non insect pests and pest control methods
- Introduction and classification of weeds
- Weed control systems
- Pests, insects
- Insect pest control methods
- Causal agents of plant diseases and common plant diseases
- Characteristics of plant diseases
- Plant diseases control methods
- Equipment used in pest control
- Safety measures in pesticide usage

4. Nature of the tool :
- Hold an exhibition to illustrate types of pests in the field, nature of the damage made and control methods to educate the school community and staff.

5. Objectives of evaluation :
- Identify the common pests in crop production using specimens
- Educate students on the nature of the damage made by pests in crop production
- Present pest control methods creatively
- Successful organisation of the exhibition

6. Instruction for the Teacher for the implementation of plan

For teacher :
- Introduce the evaluation tool to the class, when commencing, competency level 11.1
- Divide the class into three groups
- Assign the following topics to the three groups
  - insects and non insects pests
  - plant diseases
  - weeds
- Let students be aware of the time allocation for an evaluation tool
  - Week 1 - Identify the required informations and specimens
  - Week 2 - Prepare for the exhibition

- Week 3 - Prepare for the exhibition
- Week 4 - hold the exhibition

- Given the required instructions for the exhibition and monitor continuously

For students :

- All three groups get together and plan the exhibition
- Collect informations and specimens relevant to own group
- Prepare exhibits base on the informations and specimens collected
- Place the exhibits in relevant locations
- Hold the exhibition on the scheduled date

7. Evaluation criteria and marking profile:

Criteria for evaluation	Marks			
	4	3	2	1
1. Nature of the plans prepared for successful future activities				
2. Adequacy of the informations and specimens collected				
3. Active contribution of team members				
4. Collectivity and creativity in presentations				
5. Finish of the exhibition stalls in general				

Proposed Teaching-Learning - Evaluation plan

1. Evaluation Term : 01

2. Competency levels covered : 12.2 to 12.3

3. Subject contents covered :
- Importance of post harvest technology
- Post harvest losses and types
- Various stages of post harvesting losses
- Measures to minimize post harvest losses

4. Nature of tool :
- Identify causes of post harvest losses by conducting a market research, factors that effect losses and stages of post harvest losses and propose techniques to minimize same.

5. Objectives of evaluation :
- Describe regarding post harvest losses
- Describe different stages of post harvest losses
- Describe the factors that effect post harvest losses
- Describe in detail the losses suffered at in these stages
- Describe measures to minimize post harvest losses

6. Instruction for the Teacher for the implementation of plan

For teacher :
- Introduce the evaluation tool to the class when commencing competency level 12.2
- Divide the class into two groups
- Assign the following topics to the groups
  - Post harvesting losses
  - Stages of post harvest losses
- Lets students to become aware of the time allocation for evaluation tools
  - Week 1 – plan for exploration
  - Week 2 – conduct market survey
  - Week 3 – Present report
- Give the required instruction for the market survey and monitor continuously

For students :

- All three groups get together and plan the market survey
- Carry out the market survey on the scheduled date
- Discuss collected information within group
- Present strategies to minimize harvest losses found, in relation to the information above
- Make the report and present scheduled time

7. Evaluation criteria and marking profile:

Criteria for evaluation	**Marks**			
	4	**3**	**2**	**1**
1. Proper planning				
2. Collect information				
3. Active participation				
4. Success of the proposed proposals				
5. Hand over at scheduled time				

Proposed Teaching-Learning - Evaluation plan

1. Evaluation Term : 01

2. Competency levels covered : 13.1

3. Subject contents covered :
- Concept of home garden
- Selection of an appropriate land for home garden
- Planning of home garden
- Conventional form – land preparation methods
- Urban agriculture – urban cultivation structures
- Selection of crops
- Preparation of planting materials
- Sterilization of cultivation media
- Crop establishment
- Maintenance of crop

4. Nature of tool :
- Activity to obtain a fresh balanced diet from home garden.

5. Objectives of evaluation :
- Explain the concept of the home garden
- Selection of a suitable land for home garden
- Prepare a plan for the home garden
- Selection of a suitable farming system according to the land and space
- Proper usage of agricultural equipment and tools at required stages
- Application of proper agricultural practices
- Keeping records during the activity

6. Instruction for the Teacher for the implementation of plan

For teacher :
- Introduce the evaluation tool to the class when commencing the competency level 13.1
- Divide the class into two groups
- Assign the following topics between the two group
  - Urban agriculture
  - Traditional farming
  - Let students be aware of the time allocation for evaluation tool

- Week 1 – Selection of land, preparation of plan, selection of crops, Land preparation supply of material for pots/ structures, preparation of nursery media (plotting media) sterilization
- Week 2 – Preparation of planting material Sterilization, construction of structures, Filling of planting media
  - Establishment – in nurseries
    - directly in land
  - Mulching, irrigation
- Week 3 – Maintenance, irrigation, provision of light/ shading, Identification of pests and diseases, Use of appropriate measures to prevent
  - Establishment and maintenance of nursery plants in the field/ pots or containers/ in structures
    It is better to maintain the crop until harvesting)

For students :
- Collect information relevant to own group
- Select a suitable site in school garden
- Prepare a plan to suit the land which can maximize utilization of resources
- Follow teacher's advice or instructions

7. Evaluation criteria and marking profile:

Criteria for evaluation	**Marks**			
	4	**3**	**2**	**1**
1. Planning				
2. Carrying on the activity				
3. Collectivity leadership and fellowship within the group				
4. Time management				
5. Field book				

Proposed Teaching-Learning - Evaluation plan

1. Evaluation Term : 02

2. Competency levels covered : 14.4, 14.5, 14.11, 14.18

3. Subject contents covered :
- Animal nutrition
- Structure of the digestive systems
- Animal rearing systems

4. Nature of tool :
- A presentation regarding animal nutrition, structure of digestive systems and animal rearing systems for agriculture students in Grades 12, 13

5. Objectives of evaluation :
- Present the details of rich nutrient components in animal feeds
- Classification of animal feeds
- Identify common food ingredients and composition of those which are available in the area
- Test pasture conservation methods
- Describe structure and functions of the digestive system of poultry and cattle
- Planning of suitable housing for poultry and cattle
- Describe the rearing methods/ system of poultry and cattle

6. Instruction for the Teacher for the implementation of plan

For teacher :
- Introduce the evaluation tool to the class before commencing the competency level 14.4
- Divide the class into two groups
- Instruct groups to collect information under the following topics
  - Poultry nutrition, rearing systems of poultry
  - Ruminant nutrition (cattle) cattle rearing system
- Inform students, of the time allocation for evaluation tools
  - First two weeks – collecting information

- First three days of the last week – Organize information and to get ready to make present action
- Last two days of last week – Presentation
  - Instruct students to manage the presentation within seven minutes

For students :
- Divide the topic into sub topics to ensure that every one got a topic
- Collect information using different media relevant to the topic
- Discuss the collected information within the group
- Organizing the information and preparing for the presentation
- Do the presentation on scheduled date within the time frame given

7. Evaluation criteria and marking profile:

Criteria for evaluation	**Marks**			
	4	**3**	**2**	**1**
1. Accuracy of organization				
2. Collection of required level of information				
3. Usage of audio visual teaching aids				
4. Presentation facts according to topic				
5. Presentation to within scheduled time				

Proposed Teaching-Learning - Evaluation plan

1. Evaluation Term : 02

2. Competency levels covered : 14.7

3. Subject contents covered :
- Structure of on egg
- Selection of eggs for hatching

4. Nature of the tool :
- A practical activity on the following topics, such as, identification of the structure of an egg and, selection of eggs for hatching.

5. Objectives of evaluation :
- Describe the structure of an egg
- Explain the characteristic features of eggs suitable for hatching

6. Instruction for the Teacher for the implementation of plan

For teacher :
- Use the practical activity in competency level 14.7 as an evaluation tool
- Introduce the evaluation tool to the class before commencing the practical
- Evaluate students according to the relevant criteria, in the course of the practical

For students :
- Follow the teachers instruction
- Conduct the practical activity in competency level 14.7
- If necessary seek the help of the teacher

7. Evaluation criteria and marking profile:

Criteria for evaluation	**Marks**			
	4	**3**	**2**	**1**
1. Following instructions 2. Accuracy of task 3. Proper record keeping 4. Time management 5. Cooperation within group				

Proposed Teaching-Learning - Evaluation plan

1. Evaluation Term : 02

2. Competency levels covered : 14.19, 14.20

3. Subject contents covered :
- Importance of post animal disease management
- Factors effecting diseases
- Common disease symptoms
- Disease control/ management
- Diseases of cattle
- Diseases of poultry (four)
- Diseases transmitted from animals to human (Somatic diseases)

4. Nature of tool :
- Open book test for identification of cattle and poultry diseases and disease management

5. Objectives of evaluation :
- Explain the importance of animal health management
- Give reasons for animal diseases
- State common symptoms of animal diseases
- Name common cattle and poultry diseases
- Describe symptoms of each disease
- Explain treatment and preventive measures for diseases
- Selection of diseases which are transmitted from farm animals to humans (Tomatic diseases)

6. Instruction for the Teacher for the implementation of plan

For teacher :
- Carry on the evaluation after the competency levels 14.19 and 14.20
- Prepare a questionnaire
- Schedule a date and time for implementation of evaluation tool
- Divide students into three groups and advise them to collect information on the following topics
  - Causes of animal diseases and common symptoms of diseases
  - Cattle diseases

- Poultry (fowl)diseases
- Provision of related books, leaflets or internet facilities
- Inform students of evaluation process
- Ask students to complete the evaluation within the time frame and to hand over same.

For students :
- Follow the teacher's instructions
- Participate in the evaluation at the correct time
- Discuss the information within group
- Complete the evaluation at scheduled time and handover the answer scripts

7. Evaluation criteria and marking profile:

Criteria for evaluation	Marks			
	4	3	2	1
1. Accuracy of the answers				
2. Adequacy of information				
3. Active contribution within the group				
4. Compliance to the teacher's instructions				
5. Time management				

Grade 13
List of Practical Activities

	Name of the Practical	Competency Level
1)	Identify the external characteristics of insect pests, orders and other non insect pests which attack crop production	11.2
2)	Classification of pest	11.5
3)	Identification of weeds	11.7
4)	Classification of weeds	11.10
5)	Identification of diseased plant specimens	11.12
6)	Identification of parts of a knapsack sprayer	13.2
7)	Identification of paddy varieties	13.3
8)	Preparation of seed nurseries for paddy cultivation	14.4
9)	Identification of animal feeds	14.5
10)	Comparison and study digestive systems of cattle and poultry	14.7
11)	Selection of eggs for hatching and study the structure of an egg	14.7
12)	Study the different growth stages of an embrio of an egg	14.17
13)	Finding out the fat percentage of milk	14.17
14)	Finding out the solid non fat percentage of milk	14.17
15)	Preparation of yoghurt	15.3
16)	Preparation of Mango chutney	15.3