

Open/Limited Competitive Examination for Recruitment to Class III of the
 Sri Lanka Agricultural Service - 2009 (2010)

(02) Subject Matter Paper (Agriculture Officer/Lecturer)

Answer all questions. Each question carries equal marks.

Two hours

1. (i) Give the complete name of the Ministry (as of January 2010) that is responsible for the agricultural development in Sri Lanka.
 (ii) What is the year of adoption of the present National Agriculture Policy in Sri Lanka?
 (iii) What is the "Vision" of the Department of Agriculture, Sri Lanka?
 (iv) State the growth rate of the Agricultural sector in Sri Lanka as recorded in 2008.
2. (i) State the number of agro-ecological zones in Sri Lanka based on the latest classification.
 (ii) What was the basis used to identify the agro-ecological zones in the above classification?
 (iii) State the importance of the knowledge on agro-ecological zones in agriculture.
3. (i) What is meant by "Integrated Farming"?
 (ii) State **two** examples for integrated farming systems in Sri Lanka.
 (iii) Briefly describe the advantages of integrated farming compared to modern farming systems.
4. (i) What is a "Crop Wild Relative"?
 (ii) Name **five** species of wild relatives of rice found in Sri Lanka.
 (iii) What is the importance of crop wild relatives in Agriculture?
5. (i) What is "Transpiration" in plants?
 (ii) List **three** important effects of transpiration on plant growth and development.
 (iii) List **five** environmental factors that affect the rate of transpiration in plants.
6. (i) What is a "Field Crop"?
 (ii) State **three** major cereal crops grown in Sri Lanka and identify whether they are C₃ or C₄ plants.
7. (i) State the hybrid varieties developed and recommended by the Department of Agriculture in the following crops:
 (a) Maize
 (b) Rice
 (ii) State **two** advantages and **two** disadvantages of using hybrid varieties in crop production.
8. (i) What is the duration of the vegetative phase of a 4½ month old rice variety?
 (ii) State the critical period of weed competition in rice.
 (iii) State **three** reasons why *Echinochloa crusgalli* has been identified as one of the most troublesome weeds in rice cultivation.
9. (i) What is meant by "Cropping Intensity"?
 (ii) Briefly describe the "Bethma system" of cultivation under minor irrigation schemes.
 (iii) State the importance of Crop Diversification under minor irrigation schemes.
10. (i) What is meant by "Weed Management"?
 (ii) Define "Biological Control of Weeds" and give **two** advantages of this technique when compared to application of herbicides?
 (iii) Name the bio-control agent used in Sri Lanka to manage the population of *Salvinia molesta*.

11. Differentiate between the following:
- (i) Cereal Crops and Legume Crops
 - (ii) Soil Texture and Soil Structure
 - (iii) Annual Weeds and Perennial Weeds
12. Match each item in the column **A** with items in the column **B** of the table given below, and write the answer on your answer script using the following format.

A	B
a <i>Momordica denudate</i>	f suckers
b <i>Cyperus rotundus</i>	g perennial grass
c <i>Panicum repens</i>	h free-floating aquatic fern
d <i>Musa</i> spp.	i wild bitter gourd
e <i>Salvinia molesta</i>	j perennial sedge

- (i) a →
- (ii) b →
- (iii) c →
- (iv) d →
- (v) e →
13. (i) Define the term "Seed Dormancy."
(ii) What is the most common laboratory test used to measure seed viability and vigour?
(iii) What is the importance of dormancy in determining survival of weeds?
14. (i) Identify the causal organisms for following crop diseases (give the complete scientific names).
(a) Rice Blast
(b) Panama disease in Banana
(c) Bacterial wilt of Brinjal
(ii) State the scientific names of the following insect pests of crops.
(a) Paddy bug
(b) Pea leaf miner
(c) Maize stem borer
15. (i) Name the latest legal enactment in Sri Lanka that deals with the issues related to plant protection.
(ii) Name the **two** main national level programmes implemented by the government of Sri Lanka to develop the Northern and Eastern provinces during the post-war period?
(iii) What is the scientific inter governmental body tasked with evaluating the risk of climate change caused by human activities?
16. (i) What is meant by "Allelopathy"?
(ii) How could a person identify the impact of "Allelopathy" from that of "Competition" within a plant community.
(iii) Name a holo-parasitic weed that affects the crop production in Sri Lanka.
17. (i) What are the seed rates (kg) of following crops that are required to produce seedlings for transplanting an extent of 1 ha.
(a) Chilli
(b) Tomato
(ii) What is the main limitation in producing true seeds of onion under protected culture in Sri Lanka?
18. (i) State the "Green House Gases" that exclusively result from human industrial activities.
(ii) Briefly explain how increasing concentration of CO₂ in the environment would affect the productivity of rice.
19. (i) Give the scientific name of the "Papaya Mealybug."
(ii) What is the characteristic feature of the plant species affected by the papaya mealybug?
(iii) Name the biological control agent (give the scientific name) used in Sri Lanka to overcome the problem of papaya mealybug.

20.
 - (i) What is a "Bio-fertilizer"?
 - (ii) List **four** advantages of applying bio-fertilizers when compared to chemical fertilizers.
 - (iii) Name **two** types of bio-fertilizers that are used in Sri Lanka.

21.
 - (i) Differentiate between a "Natural Ecosystem" and an "Agricultural Ecosystem."
 - (ii) Name **three** biotic and **three** abiotic constraints to agricultural productivity.
 - (iii) State the importance of biodiversity in agriculture.

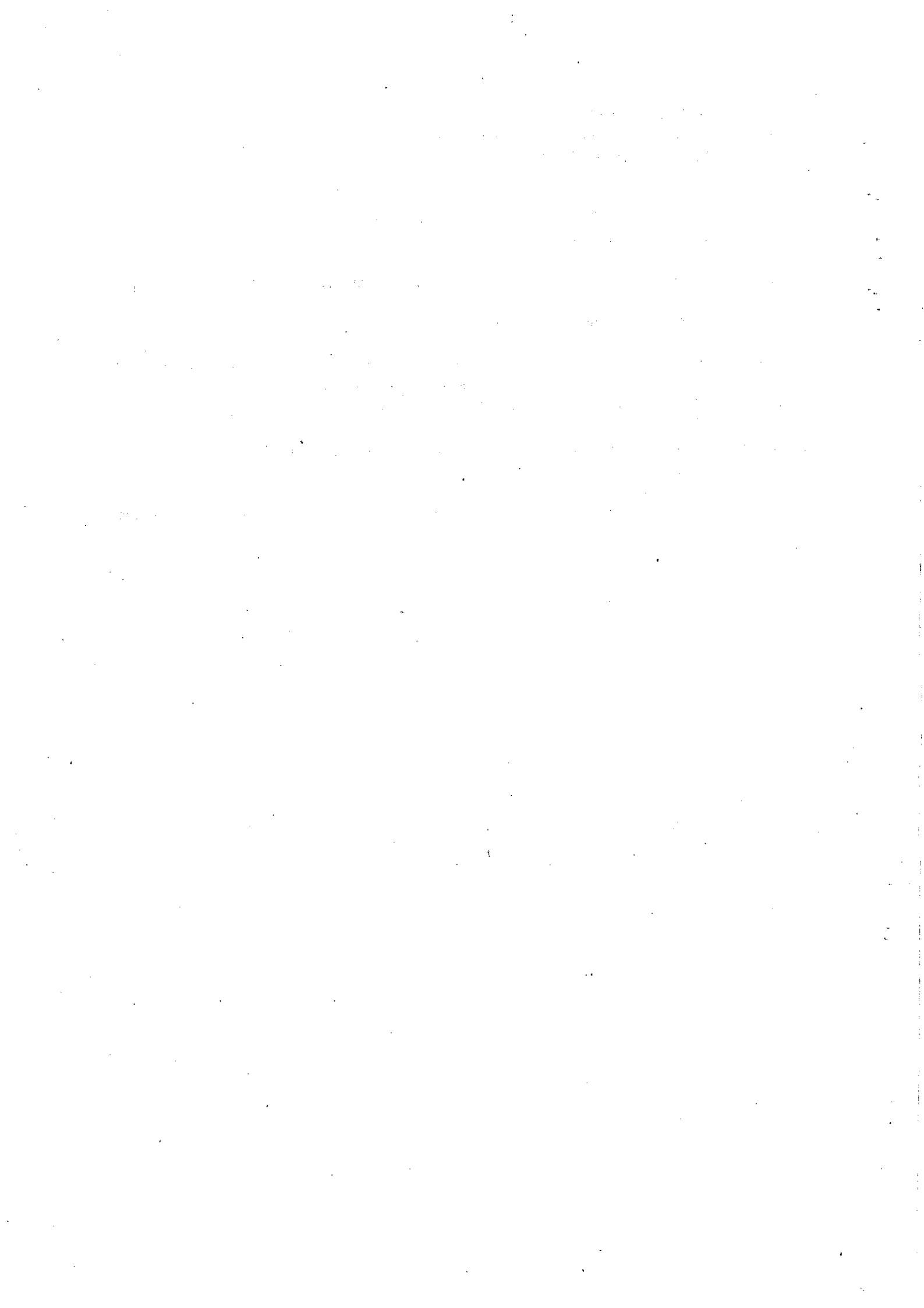
22.
 - (i) Define the terms "Epigeal Germination" and "Hypogeal Germination" **and** list **two** examples of crops for each case.
 - (ii) State **three** hormones / groups of hormones, that regulate seed germination.

23.
 - (i) Among the flowering plants of Sri Lanka, state the percentage of plants that are endemic to the country.
 - (ii) What are the **two** most important factors affecting the biodiversity at a global scale.
 - (iii) Name **four** ecosystem services that would benefit agricultural production.

24. State **five** reasons to indicate the importance of agricultural extension to agricultural development of the country.

25.
 - (i) What are the objectives of "Communication"?
 - (ii) Name **four** subject areas that an Agricultural Extension Officer would be responsible in performing the tasks.

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 முழுப் பதிப்புரிமையுடையது]
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Open/ Limited Competitive Examination for Recruitment to Class III of the
 Sri Lanka Agricultural Service - 2009 (2010)

(03) Subject Matter Paper
 (Research Officer)

Two hours

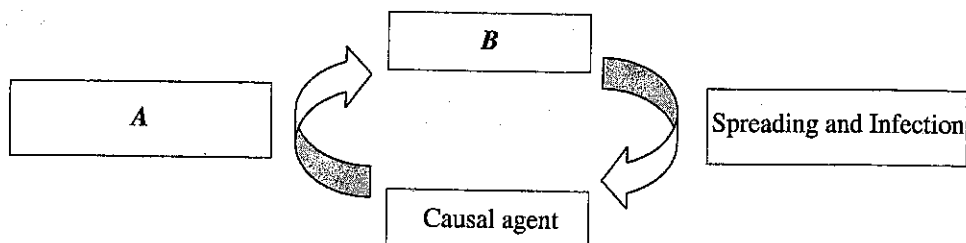
Select either Part A or Part B. All questions carry equal marks.

Part A

1. (i) What is the main basis for classification adopted by Carolus Linnaeus for the angiosperms?
 (ii) What are the **three** unique features of a plant cell that differentiate from the cells of other eucaryotic organisms?
 (iii) Identify the **two** main groups of chemical components found in primary plant cell wall.
2. An outline of the classification of a plant found in Sri Lanka is given below.
 Kingdom : Plantae
 Division : Magnoliophyta
 Class : Liliopsida
 Family : Pontederiaceae
 (i) Based on the 'Division', identify the category, which the plant belongs to?
 (ii) What is the characteristic feature of plants belonging to Class 'Liliopsida'?
 (iii) Name a plant (give complete scientific name) that fits into the above classification.
3. Select whether the following statements given regarding photosynthesis, are **true** or **false**
 (i) Rubisco is the enzyme that fixes carbon dioxide in the Calvin cycle.
 (ii) PEP Carboxylase is the key enzyme in photosynthesis in C₄ plants.
 (iii) During the Calvin cycle glyceraldehyde-phosphate is reduced to phosphoglyceric acid.
 (iv) The Calvin cycle occurs only in the presence of light.
 (v) For every carbon fixed, it requires one ATP and one NADPH.
4. (i) What is the first detectable compound of carbon fixation in C₃ plants?
 (ii) Briefly explain how photorespiration is prevented in C₄ plants.
5. (i) Define the following terms
 (a) Heterosis
 (b) Clones
 (c) Phenotypes
 (ii) What is the basic premise of Quantitative Genetics?
 (iii) State the Hardy-Weinberg law.
6. (i) What is an arthropod?
 (ii) Describe metamorphosis of an insect.
 (iii) What are the **three** main feeding niches of insects?
7. 'Economic threshold' is an important tool in insect pest management. Answer the following questions.
 (i) What is 'economic threshold' of insect pests?
 (ii) What is the importance of insect pest management in agriculture?

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8. (i) Give the scientific name of the papaya mealybug.
(ii) What is the characteristic feature of the plants species affected by the Papaya mealybug?
(iii) Name the bio-control agent (give the scientific name) used in Sri Lanka to overcome the problem of papaya mealybug?
9. (i) Name **four** main biotic factors that cause plant diseases.
(ii) A figure showing the cyclic nature of occurrence of plant diseases is given below. Identify the segments A and B to complete the cycle.



- (iii) What is 'Koch Postulates'?
10. (i) What are the characteristic symptoms of the following plant diseases?
(a) Bacterial wilt in tomato
(b) Anthracnose in Brinjals
(ii) List **three** modern disease diagnostic techniques.
(iii) What are the main principles of plant disease control?
11. (i) What is meant by 'Sexual reproduction' in plants?
(ii) Name the main vegetative propagation structures of the following plants
(a) *Cyperus rotundus*
(b) *Allium cepa*
(c) *Centella asiatica*
(iii) List **two** advantages and **two** disadvantages each of sexual propagation and vegetative propagation.
12. (i) Define the term 'Biological Diversity'.
(ii) Briefly describe the **three** hierarchical levels of biological diversity.
(iii) What are the **two** major threats to biological diversity at the global level.
13. (i) What is an Invasive Alien Species (IAS)?
(ii) Name **three** free-floating invasive alien plants found in Sri Lanka (give the scientific names).
(iii) Name the bio-control agents (give the scientific names) for **any two** of the invasive alien plants listed under (ii) above.
14. (i) Name the international convention that Sri Lanka has become a signatory in 1992, which identifies activities related to IAS.
(ii) Name the International Convention **and** the Parliamentary Act implemented in Sri Lanka that governs the activities related to Plant Protection in the country.
(iii) Name the plant species that was prohibited from being transported within Sri Lanka, through an extraordinary gazette notification issued in 2000.
15. (i) What is secondary dormancy in seeds?
(ii) List **three** techniques to overcome secondary dormancy in seeds.
(iii) Briefly describe **three** main methods adopted by plants to persist in an ecosystem.

16. (i) What is 'Plant Breeding'?
- (ii) Define the term "Somaclonal variation".
- (iii) Briefly state how genetic engineering has helped plant breeding activities.
17. (i) What are the main pathways by which plants get pollinated?
- (ii) List **three** main conservation methods of plant genetic resources.
18. (i) What are "Abzymes"?
- (ii) What is meant by "Reverse Genetics"?
- (iii) Briefly indicate how a synthetic seed is produced.
19. (i) What are the **six** basic steps involved in Plant Tissue Culture?
- (ii) What is totipotency?
- (iii) What do you understand by the following terms:
- (a) Double Haploids
- (b) Somatic Embryogenesis
20. (i) What are the **three** basic steps of a Polymerase Chain Reaction (PCR) cycle?
- (ii) What is meant by Molecular Breeding?
- (iii) What are the **advantages** in using molecular markers in plant breeding when compared to biochemical markers?
21. (i) What is a "bio-fertilizer"?
- (ii) List **four** advantages of using bio-fertilizers when compared to chemical fertilizers.
- (iii) Name **two** types of bio-fertilizers that are used in Sri Lanka.
22. (i) Define the terms "epigeal germination" and "hypogeal germination" **and** list **two** examples of crops for each case.
- (ii) State **three** hormones/groups of hormones that regulate seed germination.
- (iii) What is the role of the phytochrome system in seed germination of plants.
23. (i) What is "Glycemic Index" (GI) of a food?
- (ii) Using the concept of GI, explain why red rice is considered as a better option to diabetic patients when compared to polished white rice.
24. Consider the following organelles in a plant cell.
- (a) Mitochondria (b) Nucleus
- (c) Microsomes (d) Cytoplasm

By using the correct letter corresponding to the above organelles, identify the location of the following. State the answer in the answer sheet along with the question number.

- (i) Chromatin
- (ii) ATP formation
- (iii) Xenobiotic metabolism
- (iv) Glycolysis
- (v) Protein synthesis
25. (i) What is the "vision" of the Sri Lanka Department of Agriculture?
- (ii) What was the date and year of launch of the presently implemented National Agriculture Policy of Sri Lanka?
- (iii) Name **three** cereal crops and **three** fruit crops that have been identified under the "Api Wawamu Rata Nagamu" Programme.

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Part B

1. (i) Give the complete name of the Ministry (as of January 2010) that was responsible for the agricultural development in Sri Lanka.
(ii) What is the year of adoption of the present National Agriculture Policy in Sri Lanka?
(iii) What is the "Vision" of the Sri Lanka Department of Agriculture?
(iv) State the growth rate of the Agricultural sector in Sri Lanka as recorded in 2008.
2. Fill in the blanks in the following statements. Write the answer in your answer sheet along with the question number.
(i) The contribution of the agriculture sector to the Gross Domestic Production (GDP) of Sri Lanka in 2008 is
- (ii) The number of agro-ecological zones in Sri Lanka according to the latest classification is
- (iii) The year of launch of the "*Api Wawamu Rata Nagamu Programme*" was
3. Identify the periods of a given year for the occurrence of the following
(i) North-east monsoon
(ii) South-west monsoon
(iii) Inter-monsoon I
(iv) Inter-monsoon II
4. Briefly describe the following.
(i) Importance of the knowledge on Growing Degree Days (GDD) of a crop.
(ii) Role of RuBP Carboxylase in plants.
(iii) The "Hill Reaction" in photosynthesis.
5. (i) What is "Transpiration" in plants?
(ii) List **three** important effects of transpiration on plant growth and development.
(iii) List **five** environmental factors that affect the rate of transpiration in plants.
6. (i) The rice varieties in Sri Lanka are identified based on the location of the research station where the breeding program took place. In this regard explain the following terms.
(a) Bg
(b) Bw
(c) Ld
(d) At
(ii) What is the theoretical maximum grain yield of rice?
(iii) Indicate the varietal name **and** the age class of the following rice varieties released by the Rice Research and Development Institute at Batalagoda.
(a) Keeri Samba
(b) Hybrid rice
7. (i) Name the hybrid variety of Maize released by the Department of Agriculture.
(ii) What is the major physiological constraint in mung bean production?
(iii) What is the amount of fresh red chilli (kg) required to produce 1 kg of dried chilli.
8. (i) What is meant by "Crop Diversification"?
(ii) Briefly describe the importance of crop diversification under minor irrigation schemes.
9. (i) What is meant by "weed management"?
(ii) Define "Biological Control of weeds" and give **two** advantages of this technique when compared to application of herbicides?
(iii) Name the **two** bio-control agents used in Sri Lanka to manage population of *Eichhornia crassipes*.
10. Differentiate between the following,
(i) Cereal Crops and Legume Crops.
(ii) Soil Texture and Soil Structure.
(iii) Annual Weeds and Perennial Weeds.

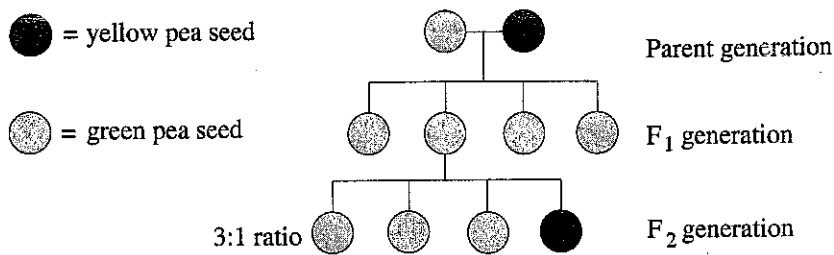
11. Match the each item in column A with items in the Column B of the table given below and write your answer in the following format.

A	B
a <i>Oryza nivara</i>	f Suckers
b <i>Cyperus rotundus</i>	g perennial grass
c <i>Panicum repens</i>	h free-floating aquatic plant
d <i>Musa spp.</i>	i wild rice
e <i>Echhornia crassipes</i>	j Perennial sedge

- (i) a →
- (ii) b →
- (iii) c →
- (iv) d →
- (v) e →
12. (i) What are the **two** main categories of rock weathering?
 (ii) What is a "Soil Profile"?
 (iii) State the most common soil type found in the dry zone of Sri Lanka?
13. (i) Name **five** most important factors that affect soil formation.
 (ii) State **five** functions of humus.
14. (i) What is "Soil Quality"?
 (ii) Briefly explain the **three** stages of humification of organic materials during the composting process.
15. (i) Define the term "Seed Dormancy".
 (ii) What is the most common laboratory test used to measure seed viability and vigour?
 (iii) What is the importance of dormancy in determining survival of weeds?
16. (i) Write the overall equation of photosynthesis.
 (ii) State the location where the light driven reaction of photosynthesis takes place in plant leaves.
 (iii) State whether the following crops are C₃ or C₄.
 (a) Rice
 (b) Maize
 (c) Green gram
 (d) Sugar cane
17. Briefly explain why C₃ plants have lower photosynthetic efficiency when compared to C₄ plants.
18. (i) What is the reaction that takes place during "Glycolysis" in respiration?
 (ii) Following chart gives the four important processes of respiration. Identify the segments A, B and C in the process.
- Glycolysis → A → B → C → release of ATP
19. (i) Identify the causal organisms for following crop diseases (give the scientific names)
 (a) Rice Blast
 (b) Panama disease in Banana
 (c) Bacterial wilt of Brinjal
 (ii) State the scientific name of the following insect pests of crops.
 (a) Paddy bug
 (b) Papaya mealybug
 (c) Pea leaf miner

20. (i) State the difference between a "Gene" and an "Allele".
(ii) Fill in the blanks of the following statements. Write the correct answer in your answer sheet along with the question number.
- (a) In a cross between F_1 s, it is found that the extreme phenotype occurs about 1 out of every 4000 offspring. The number of loci that control this trait is
 - (b) A transfer of genetic material between non-homologous chromosomes is called
 - (c) A phenotype refers to the actual of an individual.

21. (i) In the diagram below, what accounts for the green pea seed in the F_2 generation?



- (ii) Identify whether the following statements are **True** or **False**.
- (a) Offspring inherits the acquired traits of parents.
 - (b) Genes determines a traits of an organism.
 - (c) A mutation cannot occur due to the impact of drugs on DNA replication.
 - (d) Traits that are not inherited are called acquired traits.

22. (i) Define the terms "Replication" and "Randomization".
(ii) What is "Type 1 Error" and "Type II Error" in experiments?
(iii) If a researcher intends to conduct a factorial experiment in a levelled paddy field, with surface irrigation techniques and seed rates as the two factors (each with two levels) and with three replicates;
- (a) Propose an experimental design for the study.
 - (b) Draw an ANOVA table giving only the sources of variation and degrees of freedom.

23. (i) Name the latest legal enactment in Sri Lanka that deals with the issues related to plant protection.
(ii) Name the **two** main national level programmes implemented by the government of Sri Lanka to develop the northern and eastern provinces during the post-war period?
(iii) What is the scientific inter governmental body tasked with evaluating the risk of climate change caused by human activity?

24. (i) What is meant by "Allelopathy"?
(ii) How could a person identify the impact of "Allelopathy" from that of "Competition" within a plant community.
(iii) Identify whether the following statements are **True** or **False**.
- (a) Endotoxins are produced by gram negative bacteria
 - (b) Exotoxins are frequently encoded on plasmids
 - (c) Gram positive bacteria will grow on agar.

25. (i) State the "Green House Gases" that exclusively result from human industrial activities.
(ii) Briefly explain, how increasing concentration of CO_2 in the environment would affect the productivity of rice.

Open/Limited Competitive Examination for Recruitment to Class III of the
Sri Lanka Agricultural Service - 2009 (2010)

(04) Subject Matter Paper (Agricultural Economist)

Two hours

Answer **all** questions. All questions carry **equal** marks.

1. (i) State the 'law of diminishing marginal returns' in Production Economics.
(ii) Graphically show Total Product (TP), Average Product (AP) and Marginal Product (MP) curves of a typical production process with a single input. Then identify the **three** stages of production.
2. A Cobb-Douglas production function with two inputs is given as, $y = 150 x_1^{0.4} x_2^{0.5}$
 - (i) What are the partial production elasticities of x_1 and x_2 ?
 - (ii) Provide **two** limitations of Cobb-Douglas model in representing a production process.
3. A single input production function is given as, $y = A x^\alpha e^\gamma$
 - (i) Identify the production functional form.
 - (ii) How do you interpret γ ?
 - (iii) Under what condition, does this production function reduces to a Cobb-Douglas model?
4. (i) What do you understand by "market failures.?"
(ii) Give **four** reasons for market failures.
5. (i) Provide different types of risks and uncertainties in agriculture.
(ii) What are the strategies that could be adopted to overcome the above?
6. (i) Explain "consumer surplus" and "producer surplus."
(ii) Using an appropriate diagram, illustrate consumer surplus and producer surplus.
7. (i) What were the main objectives of land settlement and colonization programmes implemented in Sri Lanka?
(ii) Give **two** landmark Land Reform Acts introduced in Sri Lanka, after the 1948.
8. The total cost function of a firm is given as, $TC = 6Q^2 + 3Q + 4000$
where Q = number of units produced.
 - (i) Using the above function obtain expressions for Average Total Cost (ATC), Average Variable Cost (AVC), Average Fixed Cost (AFC) and Marginal Cost (MC).
 - (ii) Illustrate all above curves in one graph.
9. (i) Providing examples, explain different types of externalities found in agricultural production.
(ii) What are the basic characteristics of public goods?
10. (i) What are the specific characteristics of agricultural commodities that influence marketing?
(ii) List **two** government institutions involved in agricultural marketing, together with their roles.
11. Who are the different types of middlemen found in agricultural marketing?

12. The market Demand (Q_d) and Supply (Q_s) of a particular commodity is given below;

$$Q_d = 136 - 12P$$

$$Q_s = -114 + 13P$$

where P = price per unit in rupees.

- (i) Find the equilibrium price and quantity of the commodity.
 - (ii) If the government sets a price of Rs 11.00 for this commodity, then what will be the excess supply?
13. The utility function of two consumer goods x_1 and x_2 is given below;
- $$U = x_1^2 x_2^2$$
- The unit prices of x_1 and x_2 are Rs 50.00 and Rs 75.00, respectively. Consider that the consumer has Rs 1,500.00 to be spent on these two goods. Find the amounts of x_1 and x_2 that should be consumed, if the consumer maximises his utility.
14.
 - (i) Explain the concept of "returns to scale" in Economics.
 - (ii) Using appropriate diagrams of isoquants, illustrate the situations of increasing, decreasing and constant returns to scale.
 15.
 - (i) Explain elasticity of substitutions between two inputs in a production process.
 - (ii) Given that the production technology is a Cobb-Douglas model, what is the elasticity of substitution?
 16.
 - (i) What are the main approaches used in studying agricultural markets?
 - (ii) What is "marketing margin"?
 17.
 - (i) What are the **four** factors of production?
 - (ii) What are the key decisions that should be made by a Farm Manager?
 18. Explain 'substitution effect' and 'income effect'.
 19.
 - (i) What is "comparative advantage"?
 - (ii) How does this differ from competitive advantage?
 20. What are the constraints in efficient land utilization in Sri Lanka?
 21. What are the most important farm records that should be maintained in a farm?
 22. Briefly describe the following:
 - (i) Essential goods
 - (ii) Inferior goods
 - (iii) Luxury goods
 23.
 - (i) Describe the difference between 'supply expansion / contraction' and 'supply shift'.
 - (ii) List **three** factors that determine price elasticity of demand.
 24. What are the **four** major types of factors that affect the supply of land resources?
 25.
 - (i) State the main steps in land use planning.
 - (ii) What do you understand by "land rent" found in Land Economics?