STRATHMORE BUSINESS SCHOOL

MASTER OF MANAGEMENT IN AGRIBUSINESS

MMA 8301: ADVANCED TECHNOLOGIES APPLICATIONS IN AGRIBUSINESS

Module 4A/B Examinations

DATE: Tuesday, 14th January 2025 **TIME:** 3 Hours

Instructions:

1. The Examination Paper consists of **FOUR QUESTIONS**.

2. Answer **QUESTION #1 (COMPULSORY)** and any other **TWO** Questions.

Question #1:

Below is an excerpt from a policy brief, "***Making climate-smart agriculture work for the poor***", ICRAF *Policy Brief 12: Making climate-smart agriculture work for the poor. Nairobi, Kenya. World Agroforestry Centre (ICRAF)* by Neufeldt *H, Kristjanson P, Thorlakson T, Gassner A, Norton-Griffiths M, Place F, Langford K, 2011.*

By 2050 approximately 70% more food will have to be produced to feed growing populations, particularly in developing countries. Agriculture is already causing increased conversion of lands and placing greater pressure on biological diversity and natural resource functions than ever before. As climate change causes temperatures to rise and precipitation patterns to change, more weather extremes will potentially reduce global food production. Agriculture is rapidly evolving to address these drivers of change, for instance through irrigation, fertilizers, and the provision of better germplasm for higher productivity and improved products. In many less developed parts of the world, increased production has occurred through the expansion of agricultural lands rather than through intensification. At a global scale, both intensification and extensification are currently having a significant negative effect on the environment; depleting the natural resource base upon which we rely. The need to reduce the environmental impacts while increasing productivity requires a notable change in the way agriculture currently operates. 'Climate-smart agriculture' has the potential to increase sustainable productivity, increase the resilience of farming systems to climate impacts and mitigate climate change through greenhouse gas emission reductions and carbon sequestration.

(a) With an excerpt given above as a starting point, explain any FOUR emerging trends in Agriculture Technology that promises at least sufficient food for the world population in the coming years.

[4 Marks]

(b) Smart technology promises a lot of food production benefits despite several limitations and especially for the poor population in the low-income countries. Explain with current examples, any FOUR limitations of these technologies that make the sufficiency attainment difficult. **[4 Marks]**

(c) Current technologies like image analysis aid in predicting and optimizing crop yields, benefiting farmers both economically and operationally. Explain with an illustrative diagram the techniques or procedure of Crop Yield Detection through Image Analysis. **[6 Marks]**

(d) Several climate factors affect crop productivity, and their understanding is very crucial for sustainable agricultural management. Explain any THREE examples of major factors that impact crop productivity currently in the World. **[6 Marks]**

Question #2:

Below is an excerpt from an article, "***A Glance at agricultural Decision Support Systems***," *by Sridevy, S. and Djanaguiraman, M., from The Pharma Innovation Journal, 12(5): 755-757, 2023.*

Traditional methods of agriculture which include ploughing using bullocks followed by plough, sowing based on crop calendar, irrigation methods such as furrow irrigation, basin irrigation, fertilizers and manure application and harvesting were practiced by farmers based on the knowledge acquired from the ancestors. But, in the present scenario, due to various constraints in agriculture, farming community requires an advanced technology to maximize their productivity which can be satisfied by an information system called Decision Support System. Due to water scarcity, it is not so possible for furrow or basin irrigation where the loss of water occurs as well as the growth of weeds exists. This can be overcome by the drip irrigation system and tile drainage. Through DSS, the field can be irrigated based on soil moisture contents thereby reducing water loss. Soil nutrients play a significant role in plant growth. Soil nutrients do not remain constant on all places. It varies from place to place. When fertilizers are applied on to the field to enrich the nutrients manually, it may result in excess or deficit. Through Variable Rate Technology (VRT), fertilizers can be applied to the field based on the soil requirements. Major agricultural loss is due to pests and diseases. Disease occurs when the weather is favourable for the pathogen to survive. Diseases can be forecasted by the weather forecasting system integrated with DSS. Farmer, being not aware of the future market value may sell his/her produce in the market which does not yield the desired profit. Through Market Information System (MIS), it can be overcome thereby the produce can be sold in the market at appropriate time for profitable market value. Post harvesting loss can be avoided by weather forecasting system as well as market information system.

(a) With an excerpt given above as a starting point:

(i) Explain with examples, any THREE advantages of Decision Support Systems (DSS). **[3 Marks]**

(ii) Explain with examples, any FOUR sources of data for Decision Support Systems (DSS). **[4 Marks]**

(b) Decision Support Systems will rely on different models given the abundance of data from the various sources and of diverse types.

(i) Explain any THREE characteristics of decision Support Systems **[3 Marks]**

(ii) Explain any FOUR advantages of modelling in the Decision Support Systems **[6 Marks]**

(c) The implementation of Decision Support Systems in Smart Agriculture requires a detailed risk and investment analysis. Explain any FOUR key issues that have potential to reduce the potential outcomes of the implementation of the Decision Support Systems. **[4 Marks]**

Question #3:

Autonomous Systems in Smart Agriculture integrate advanced technologies like the Internet of Things (IoTs) e.g., sensors etc., Artificial Intelligence (AI) and Machine Learning that operate various farming processes independently or with minimal human intervention.

(a) Discuss any TWO characteristics of autonomous systems as used in Smart Agriculture **[4 Marks]**

(b) Explain any THREE types of sensors and their respective uses in Smart Agriculture, giving details on why that data and/or information captured in necessary. **[6 Marks]**

(c) Autonomous Systems generate significant information that is vital for good yield production and can lead to the consideration of intercropping given the different requirements of crops.

(i) Explain any TWO of intercropping systems readily applicable in Smart Agriculture. **[4 Marks]**

(ii) Using examples of crops, explain THREE any three advantages of intercropping that are applicable for both subsistence and large-scale farmers. **[6 Marks]**

Question #4:

(a) Distinguish between climate smart Agriculture and conventional Agriculture with use of examples. **[4 Marks]**

(b) Given the growing demands for food and the issues of environmental impact, explain any TWO key elements of Agriculture 4.0 revolution. **[4 Marks]**

(c) Explain any TWO potential outcomes of the implementation of Agriculture 4.0 in current farming practices. **[6 Marks]**

(d) Vertical Farming is emerging as an alternative form of farming that can increase efficiency in the food chain. Explain any THREE advantages of vertical farming. **[6 Marks]**