Government of **Western Australia**
School Curriculum and Standards Authority

SAMPLE COURSE OUTLINE

AGRICULTURAL SCIENCE AND TECHNOLOGY

ATAR YEAR 12

Acknowledgement of Country

Kaya. The School Curriculum and Standards Authority (the Authority) acknowledges that our offices are on Whadjuk Noongar boodjar and that we deliver our services on the country of many traditional custodians and language groups throughout Western Australia. The Authority acknowledges the traditional custodians throughout Western Australia and their continuing connection to land, waters and community. We offer our respect to Elders past and present.

Disclaimer

Any resources such as texts, websites and so on that may be referred to in this document are provided as examples of resources that teachers can use to support their learning programs. Their inclusion does not imply that they are mandatory or that they are the only resources relevant to the course. Teachers must exercise their professional judgement as to the appropriateness of any they may wish to use.

Sample course outline

Agricultural Science and Technology – ATAR Year 12

Unit 3 and Unit 4

Science Inquiry Skills align with the content of the unit and are integrated into the learning experiences.

Science Inquiry Skills

Hypothesis as a science driver

- identify, research and construct questions for investigation; propose hypotheses; and predict possible outcomes

Data processing and analysis

- distinguish between primary and secondary data, and between primary and secondary information sources
- represent data in meaningful and useful ways, including using appropriate graphic representations and correct units and symbols
- organise and process data to identify trends, patterns and relationships
- identify and distinguish between random and systematic errors, and describe their effect on validity and reliability of data
- evaluate how the nature of the procedure and the sample size may influence limitations in data

Interpreting data, drawing conclusions and evaluating scientific claims

- select, synthesise and use evidence to make and justify conclusions
- interpret a range of scientific texts, and evaluate processes, claims and conclusions by considering the quality of available evidence, and use reasoning to construct scientific arguments

Communicating information

- communicate to specific audiences and for specific purposes using appropriate language, nomenclature and formats, including scientific reports

Semester 1

Week	Key teaching points
1–3	**Climate change and food and fibre production systems** • describe the implications of weather and climate variability on agricultural production • describe the long-term changes in rainfall and temperature patterns for an agricultural zone in Western Australia • describe the impacts of climate change on food and fibre production systems • explain climate change mitigation and adaptation management practices
4–6	**Plant growth and development of significant plants for food and natural fibre production** **Plant growth** • list and describe the source and function of the net products of photosynthesis • explain the influence of plant processes (photosynthesis, respiration, translocation and soil solution movement, and transpiration) on plant growth and development • explain the major limitations to transpiration, including the role of the boundary layer, the structure of the leaf, including surface hairs, sunken stomata and cuticle thickness, temperature, wind, and relative humidity • explain the influence of environmental factors on plant growth and development, including water availability, temperature, light intensity, and availability of carbon dioxide and oxygen • identify the five main plant hormones (auxin, gibberellins, ethylene, cytokinins and abscisic acid) and explain their role in controlling plant processes, growth and development **Task 1**: **Science inquiry – Investigating transpiration**
7–10	**Plant growth and development of significant plants for food and natural fibre production** **Plant growth (continued)** • differentiate between macro (including nitrogen, phosphorus, potassium, magnesium, calcium, carbon, oxygen, hydrogen and sulfur) and micro nutrients (including zinc, copper, boron, manganese, iron, sodium, chlorine, cobalt and molybdenum) and explain their impact on plant growth and development • explain the influence of growth medium pH on nutrient availability • explain the benefits of monitoring soil nutrient level and pH using soil tests and plant tissue tests and their usefulness in managing plant nutrition • outline how to address nutrient deficiencies with fertiliser options • explain the benefits and role of legumes in plant nutrition and soil fertility **Task 2: Test – Plant growth**
11–12	**Controlling pests and diseases** **Plant health** • for one weed, invertebrate pest and pathogen ▪ describe its common signs and symptoms ▪ describe its impact on product quality and yield ▪ describe appropriate control options **Animal health** • for one toxic weed, invertebrate pest and pathogen ▪ describe its common signs and symptoms ▪ describe its impact on product quality and yield ▪ describe appropriate control options • describe the concept of One Health and explain its impact on disease management

Week	Key teaching points
13–15	**Controlling pests and diseases** **Integrated pest management** • explain how pesticide resistance develops, including through genetic selection, genetic mutation, and under-dosing • explain how integrated pest management (IPM) programs could include chemical control, biological control, physical (shearing, ploughing, slashing etc.) control, cultural control and breeding for resistance • describe strategies for avoiding and managing resistance in pest populations, including avoiding repeated use of chemicals with the same mode of action • describe the importance of the principle of economic threshold in management of pests and diseases • explain the factors affecting the selection of control methods, including pest resistance, legislative requirements and environmental effects • describe management strategies for pest and disease outbreak on a local, national and international level • for one weed, invertebrate pest or pathogen, outline an IPM program that considers pest lifecycle, population level, resistance levels, environmental conditions, and legislative and regulatory requirements **Task 3: Project – Integrated pest management plan**
16	**Task 4**: **Semester 1 examination**

Semester 2

Week	Key teaching points
1–2	**Food security** • explain the main challenges associated with food and fibre security, including increasing population, food waste and competition for food between people and livestock (feed versus food) • discuss opportunities for developments and improvements which can be used to address the issues of food security, including new and upcoming technologies and strategies to ▪ reduce food waste ▪ increase yields ▪ mitigate production issues, including soil problems (salinity, erosion, acidity), loss of production area, and reduce greenhouse gas emissions • describe the conflict between short-term profitability and long-term sustainability **Task 5: Project – Food security**
3–4	**Controlling pests and diseases** **Development and application of technology to support and improve productivity** • evaluate a variety of existing and emerging technologies in food and fibre production systems, such as ▪ satellite technologies ▪ robotics and artificial intelligence ▪ precision management tools ▪ biotechnologies ▪ electronic identification systems ▪ information technologies • identify and explain constraints to adoption of technology
5–6	**Breeding and improvement** • using examples for both plant and animal breeding, explain the three main aims of breeding and selection ▪ environmental adaptability, including tolerance to climate and soil conditions, and resistance to disease and pests ▪ market demands of the consumer, including preference, product quality and safety, welfare considerations and sustainability ▪ profitability, including reducing inputs and increasing productivity • describe selection criteria relevant to breeding, including ▪ objective (quantitative) traits, such as for plants yield, produce size, protein percent in cereal crops and plant height, and for animals yield, wool fibre diameter and growth rate over time ▪ subjective (qualitative) traits, such as for plants fruit/flower taste, smell and colour, and for animals structural soundness, fibre colour, condition scoring, dag score, meat taste, meat colour and fat colour
7–8	**Plant reproduction and breeding** • describe genetic techniques used in breeding new plant varieties, including cross breeding, tissue culture, hybridisation and gene modification • evaluate common breeding techniques used in plant production, including cross breeding, tissue culture, hybridisation and gene modification • describe how plant breeding has been used to develop cultivars for specific environments, markets and optimising profitability

Week	Key teaching points
9–11	**Animal reproduction and breeding** • explain the role of hormones in reproduction and behaviour, including oestrogen, progesterone, prostaglandin, follicle stimulating hormone, luteinising hormone, oxytocin and testosterone • explain how reproductive hormones can be utilised to manipulate breeding in animal production programs • describe artificial breeding techniques, including artificial insemination and embryo transfer • explain the implication of heritability of traits on selection decisions • calculate and apply estimated breeding value (EBV) to livestock selection decisions **Task 6: Test – Breeding and improvement, plant and animal reproduction and breeding**
12–13	**Growth and development of significant animals for food and natural fibre production** **Animal digestion** • explain the digestion of carbohydrates, proteins and fats in gastric and ruminant systems, including non-protein nitrogen and microbial protein • outline the process of metabolism of key digestive products, including carbohydrates and protein **Animal nutrition** • explain the changing nutritional requirements of livestock for maintenance, growth and reproduction purposes • evaluate management practices available to manipulate growth and development and to meet market specifications of production animals, including supplementary feeding, hormone growth promotants, genetic selection • explain limitations in market acceptance of artificial growth promotants, such as growth hormone and rumen modifiers **Task 7: Science inquiry – Animal growth and development data analysis**
14	**Task 8**: **Semester 2 examination**