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

SAMPLE COURSE OUTLINE

AGRICULTURAL SCIENCE AND TECHNOLOGY
ATAR YEAR 11

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 11

Unit 1 and Unit 2

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	Introduction to Agricultural Science and Technology ATAR Year 11 course outline and assessment outlines **The development of Australian agricultural practices** • describe the main attributes and differences in agricultural and land management techniques from Indigenous Australian land management and manipulation techniques to the introduction and then adoption of European farming practises into 'sustainable and technological' Australian farming, including ▪ pre-colonisation food and fibre practices employed by Indigenous Australians, such as fire farming, fish traps, tuber propagation, hunter-gatherer ▪ traditional European farming techniques, such as those used by the original colonial settlers to survive, to profit-driven agricultural production, such as reliance on tillage, monoculture production, cultivar selection and breeding, and the shift from subsistence to commercial production ▪ modern food and fibre production strategies, such as clean, green and ethical, targeting specific market requirements, use of breeding and genetic manipulation, and the use of technology to increase production and to help address a lack of skilled labour

Week	Key teaching points
	▪ the concept of supply and demand, and the domestic and international value chains and how they influence the direction of Australian agriculture • identify the major climatic zones in Western Australia, including arid, Mediterranean, temperate, subtropical and tropical, and describe attributes that differentiate them regarding agricultural production • compare and contrast intensive systems, such as horticulture, floriculture, aquaculture, and intensive animal production, and extensive farming systems, such as broadacre cropping, sheep and cattle production, rangeland grazing systems
3–5	**Resource conservation and management in food and fibre production systems** • recognise that systems are composed of interacting components that should support each other, including inputs, outputs, boundaries and processes • recognise that plants can obtain their nutrients from soil or soil-less media (for example, aqueous media, peat moss, vermiculite and perlite) • describe the living and non-living components of soil • explain the influence of soil texture and structure on availability and holding capacity for water and nutrients • calculate water availability using the equation field capacity minus wilting point (Readily Available Water – RAW) • describe nutrient cycling, including carbon, nitrogen and phosphorus, and the water cycle **Task 1:** Project – Resource conservation and management (start)
6–7	**Resource conservation and management in food and fibre production systems** • explain production practices that have contributed to soil and water degradation issues, such as acidification, salinity, erosion, soil structural decline and eutrophication • discuss the effect of land degradation on natural resources, biodiversity, soil health and sustainability of agricultural systems • explain strategies to maintain and/or improve the quality of soil and water resources, such as cultivation practices, crop rotations, drainage methods, maintaining ground cover, and improving soil structure, soil health and ameliorating soil acidity **Task 1:** Project – Resource conservation and management (due) **Task 2:** Science inquiry – Salinity investigation (start)

8–9	**Plant structure and function**
	• outline the key physical features of plants, including:
	  • leaves, including stomata
	  • stem, including nodes, vascular system
	  • roots, including meristems
	  • flowers
	  • fruits and seeds
	• outline the functions of key plant structures, including:
	  ▪ leaves, including photosynthesis, respiration, transpiration
	  ▪ stems, including storage of products, direction of growth, components and distribution of vascular bundles
	  ▪ roots, including water, and nutrient absorption, including the influence of transpiration on the movement of water and nutrients (soil solution) towards the roots
	  ▪ flowers
	  ▪ fruits and seeds
	• compare monocotyledon and dicotyledon plants based on their morphological features, including flower arrangement, vein structure, vascular bundles, root system and number of cotyledons at germination

Week	Key teaching points
	• identify agriculturally significant annual, biennial and perennial plants • outline the key stages of growth for agriculturally significant plants, including germination, emergence, leaf formation, tillering or branching, stem elongation, flowering, seed set and senescence

10–13	**Genetics and inheritance of traits**
	• define the key terms used in genetics, including:
	  • gametes
	  • genes
	  • chromosomes
	  • allele
	  • dominant
	  • recessive
	  • homozygous
	  • heterozygous
	  • genotype
	  • phenotype
	  • autosomal trait
	  • sex-linked trait
	• explain that the sources of variations in the genotype of offspring arise at the chromosomal level due to a variety of processes, such as mutations and new genetic combinations
	• use Punnet squares to determine the potential genotype of offspring as a result of plant and animal reproduction
	• discuss the interaction between genotype and environment, and the subsequent impact on phenotype
	• evaluate breeding systems, including inbreeding, line breeding, and crossbreeding (hybrid vigour)
	• describe the role of a variety of selection criteria, including subjective and objective characteristics, on the breeding programs of production systems
	Task 2: Science inquiry – Salinity investigation (due)
	Task 3: Test – Plant structure and function and genetics and inheritance of traits

	Plant reproduction • outline the process of cross-pollination and self-pollination (sexual reproduction), including pollination vectors, such as wind, and animal vectors for example insects and birds • describe common vegetative (asexual) reproduction techniques, such as tubers, stolons, bulbs, rhizomes, layering, grafting, budding and cuttings • discuss the advantages and disadvantages of asexual reproduction in production systems, such as bananas, viticulture, stone fruits, and citrus • explain the significant difference in genetic variation between asexual reproduction and sexual reproduction • describe common sources of natural genetic variation used in plant breeding (wild, natural, seed banks)
14–15	**Plant health** • identify common pests and diseases, including weeds, invertebrates (e.g. insects, mites, and nematodes), vertebrates (e.g. rabbits) and micro-organisms (e.g. fungi, bacteria and viruses), found in plant production systems and outline their impact on product quality and yield • describe common signs and symptoms of damage by pests and diseases • describe techniques to monitor pests and diseases in a plant production system
16	**Task** 4: Semester 1 examination

Semester 2

Week	Key teaching points
1–5	**Animal digestion and nutrition** • identify and describe the functions of the key structures of monogastric digestive systems in common livestock such as poultry, pigs, and fish • explain the processes of gastric digestion • identify and describe the functions of the key structures of ruminant digestive systems such as in cattle, sheep and goats • explain the process of microbial digestion in herbivores • outline the basic nutritional requirements of production animals, including carbohydrates (including fibre), proteins, fats, vitamins and minerals • outline a variety of feed sources for production animals, including pastures and mixed ration • discuss the utilisation of energy within an animal's body, including energy losses • discuss the relationship between digestibility, palatability and feed intake • explain the impact of feed intake and feed conversion ratio on productivity • evaluate feed-on-offer (FOO), and discuss the impact on stocking rates, and dry sheep equivalent (DSE) and potential need for supplementary feeding • outline the function and use of feed additives • discuss selection of ingredients in a ration to meet the requirements of a specific production animal • formulate feed rations for optimal production using the Pearson Square method • outline the legal requirements of feeding production animals for the purposes of animal health and welfare, and biosecurity, and food safety • describe the changes in bone, muscle and fat of an animal over the growth curve and relate these to nutritional needs of the animal and consumer preferences **Task 5**: Science inquiry – Ruminant feed additives for methane reduction
6–7	**Reproduction cycle of selected production animals** • describe the functions of the parts of mammalian and avian reproductive systems • discuss the oestrus cycles of livestock relative to duration of oestrus, length of oestrus cycle, and timing of seasonal breeding operations • describe the mammalian reproductive processes, including conception, pregnancy, birth, lactation, weaning • describe the avian reproductive processes, including fertilisation, egg laying, incubation and hatching **Task 6:** Test – Animal digestion and nutrition and reproduction cycle of selected production animals
8–10	**Animal health** • identify common pests and diseases, including toxic weeds, invertebrates (e.g. insects, mites and helminths), vertebrates (e.g. foxes) and micro-organisms (e.g. fungi, protozoans, bacteria and viruses), found in animal production systems and outline their impact on product quality and yield • describe common signs, symptoms and impacts of pests and diseases • describe techniques to monitor pests and diseases in an animal production system • describe the cause, impact and control options for one example of each of the following: ▪ plant-based toxicity, such as gastrolobium species and annual ryegrass toxicity ▪ a metabolic disease, such as bloat and milk fever ▪ a hereditary disease • explain vaccination as a method of disease control

Week	Key teaching points
	Task 7: Project – Animal health (start week 8; due week 9)
11–12	**Integrated pest management** • discuss the importance of understanding pest life cycles in managing and controlling pests and diseases • outline how resistance to pesticides impacts on pest control • outline biosecurity measures such as quarantine, border control and on-farm biosecurity programs (quality assurance programs) • explain how biosecurity measures reduce risks from pests and diseases • describe and evaluate a variety of pest management options, including ▪ chemical control ▪ biological control ▪ physical and mechanical control ▪ cultural control ▪ genetic control
13–14	**Development and application of technology to support and improve productivity** • identify and explain how a variety of existing and emerging technologies could be used in food and fibre production systems to ▪ improve quality of products ▪ improve efficiency of production ▪ improve natural resource management and environmental footprint ▪ address consumer trends
15	Revision of whole year
16	**Task 8**: Semester 2 examination