AGRICULTURAL SCIENCE

PREAMBLE

This syllabus has been designed to portray Agricultural Science as an applied science with emphasis on the acquisition of knowledge and skills associated with the content. A general review of the Junior Secondary School Agricultural Science syllabus is presumed.

Candidates will be expected to answer questions on all the topics set out in the column headed ***syllabus***. The ***notes*** therein are intended to indicate the scope of the questions which will be set, but they are not to be considered as an exhaustive list of limitations and illustration.

Every school offering Agricultural Science must:

(i) establish a farm where crops are grown;
(ii) keep at least one species of ruminant and one non ruminant;
(iii) establish a fish pond where feasible.

Candidates should have practical notebooks which should contain records of individual activities based on laboratory and individual observations carried out on the school farms, field trips and also records of specimens collected. In order to enhance effective teaching/learning process and better performance of candidates, continuous assessment of candidates is recommended.

Since the main objectives of the Senior Secondary School Agricultural Science Curriculum are to:

(i) stimulate and sustain students' interest in agriculture;

(ii) enable students acquire functional knowledge and practical skills to prepare them for further studies and occupation in agriculture;

it is recommended that the study of Agricultural Science in the Senior Secondary School be supplemented by visits to well established government and private experimental and commercial farms, agricultural research institutes and other institutions related to agriculture.

EXAMINATION SCHEME

There will be three papers: Papers 1, 2 and 3 all of which must be taken. Papers 1 and 2 will be a composite paper to be taken at one sitting.

PAPER 1: Will consist of fifty multiple choice questions to be answered within 50 minutes for 50 marks.

PAPER 2: Will consist of six essay questions with each drawn from at least two themes in the syllabus. Candidates will be required to answer five of the questions within 2 hours 10 minutes for 90 marks.

PAPER 3: Will be a practical paper for school candidates and alternative to practical paper for private candidates. It will consist of four questions, all of which should be answered within 1½ hours for 60 marks.

DETAILED SYLLABUS

CONTENTS	NOTES
A. BASIC CONCEPTS 1. Meaning and importance of agriculture (a) Definition and branches of agricultural science. (b) Importance of agriculture to the individual, community and nation. 2. Problems of agricultural development and possible solutions (a) Problems related to: (i) land tenure; (ii) basic amenities; (iii) finance; (iv) transportation; (v) storage and processing facilities; (vi) agricultural education and extension; (vii) tools and machinery; (viii) farm inputs; (ix) marketing system; (x) environmental degradation. (b) Possible solutions to identified problems 3. Meaning and differences between subsistence and commercial agriculture (a) Meaning of subsistence and commercial agriculture. (b) Differences between subsistence and commercial agriculture based on their characteristics.	Assessment would include incidence of pests and diseases, vagaries of weather, labour and government policy.

(c) Advantages and disadvantages of subsistence and commercial agriculture. (d) Problems of subsistence and commercial agriculture. 4. Roles of government in agricultural development (a) Agricultural finance: (i) credit; (ii) subsidy. (b) Agricultural education (c) Agricultural extension services. (d) Agricultural policies and programmes 5. Role of non-governmental organizations in agricultural development (a) Meaning of non-governmental organizations (NGOs). (b) Roles of NGOs in agricultural development. 6.	Assessment would cover past and present programmes e.g. OFN, ADP, Farm Settlement, Agricultural Sector Rehabilitation Project (ASRP) and National Aids Coordination Secretariat. Examples of NGOs West African Rice Development Association (WARDA), International Institute for Tropical Agriculture (IITA), International Livestock Centre for Africa (ILCA), International Crop Research Institute for Semi-Arid Tropics (ICRISAT) would be

7. Agricultural laws and reforms (a) Land tenure systems in West Africa. (b) Government laws on land use in West Africa. (c) Advantages and disadvantages of the land use Act (Decree) and reforms in West Africa.	assessed. Assessment would include land use Act (Decree), Land Reforms in West Africa.
B. AGRICULTURAL ECOLOGY 1. Meaning and importance of agricultural ecology (a) Meaning of agricultural ecology and ecosystem. (b) Components of farm ecosystem e.g. biotic and abiotic (c) Interactions of the components in the terrestrial and aquatic agro-ecosystem. 2. Land and its uses (a) Meaning of land. (b) Characteristics of land – free gift of nature, immobile, limited in supply etc. (c) Uses of land: (i) agricultural purposes: - crop production; - wild life conservation/game reserve; - livestock production etc. (ii) non-agricultural purposes: - industry; - housing;	 Interaction of farm crops/animals with other components of the ecosystem in farm settings such as mono or sole cropping system, mixed cropping system, mixed farming system, fish ponds and forest (rain or savannah) would be assessed. Assessment would include of uses of land for aquaculture, forestry and apiculture. Non-agricultural uses of land such as health centres,

- transport etc. 3. Factors affecting land availability for agricultural purpose (a) Physical factors: (i) soil type; (ii) topography; (iii) land degradation; (iv) soil pollution.	church/mosque, mining, recreational centres, schools and markets would be assessed.
(b) Economic factors: (i) population pressure; (ii) expansion of industries; (iii) mining/mineral exploitation; (iv) recreation/tourism. (c) Socio-cultural factors: (i) land tenure system; (ii) religious purpose (church, mosque and shrine) etc. 4. Agro-allied industries and relationship between agriculture and industry (a) Agro-based industries and raw materials: (i) paper industry – pulp wood; (ii) beverage industry – cocoa, tea etc; (iii) textile industry – cotton; (iv) soap industry – oil, seeds etc. (b) Relationship between agriculture and industries: (i) Agriculture provides market for industrial products e.g. farm machinery, chemicals; (ii) Agriculture provides food for industrial workers. 5. Environmental factors affecting crop and animal distribution and production (a) Climatic factors e.g. rainfall, temperature, light, wind, relative humidity.	Assessment would include other agro-based industries and raw materials e.g. leather industry – hides and skin, canning industry – meat and fish. Assessment would include other relationship between agriculture and industries.

(b) Biotic factors e.g. predators, parasites, soil micro-organisms, pests, pathogens and weeds; interrelationship such as competition, parasitism, mutualism (symbiosis). (c) Edaphic factors: soil pH, soil texture, soil structure, soil type etc. 6. Rock formation (a) Types of rock: (i) igneous; (ii) sedimentary; (iii) metamorphic. (b) Processes of rock formation. 7. Soil formation and profile development (a) Factors of soil formation: the parent rock, organisms, climate, topography and time. (b) Processes of soil formation: (i) physical weathering; (ii) chemical weathering. (c) Soil profile development. 8. Types, composition and properties of soil (a) Types of soil. (b) Chemical and biological composition of soil: (i) soil macro and micro nutrients;	Assessment would cover identification, description and examples of rock types. Assessment would cover how igneous, sedimentary and metamorphic rocks are formed. The role played by each factor in soil formation would be assessed. The meaning, importance, identification and description of each horizon of the soil profile would be assessed. Assessment would cover types of

(ii) soil water; (iii) soil macro-organisms; (iv) soil microbes; (v) soil air. (c) Soil pH. (d) Physical properties of soil: (i) soil texture; (ii) soil structure;	soil and their separation into sand, silt and clay fractions, water holding capacity, porosity, capillarity, consistency etc. Determination of soil pH, causes and correction of soil acidity/alkalinity would be assessed.

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9. Plant nutrients and nutrient cycle (a) Macro and micro nutrients; their functions and deficiency symptoms in crops. (b) Factors affecting availability of nutrients in soil such as pH, excess of other nutrients, leaching, crop removal, oxidation and burning. (c) Methods of replenishing lost nutrients, e.g. crop rotation, organic manuring, fertilizer application, fallowing, liming, cover-cropping. (d) Nitrogen, carbon, water and phosphorus cycles. (e) Organic agriculture – meaning and importance. 10. Irrigation (a) Meaning of irrigation system. (b) Types of irrigation systems: (i) overhead e.g. sprinkler; (ii) surface e.g. flooding, furrow/channel, basin, border; (iii) underground e.g. perforated pipes, drips. (c) Advantages and disadvantages of irrigation systems. (d) Importance of irrigation. (e) Problems associated with irrigation. 11. Drainage (a) Meaning of drainage. (b) Importance of drainage. (c) Types of drainage systems: (i) surface drainage e.g. channel, furrow; (ii) subsurface/underground drainage.	Macro-nutrients such as N, P, K, Ca, Mg, S and Micro–nutrients such as Zn, Fe, Mo, Co, Bo, Cu would be assessed. Types of fertilizers and methods of fertilizer application would be assessed. Assessment would include the description and importance of nitrogen, carbon and water cycles.

(d) Advantages and disadvantages of drainage systems. 12. Agricultural pollution (a) Meaning of agricultural pollution. (b) Causes/sources of pollution of agricultural lands and fish ponds: (i) excessive application of agricultural chemicals; (ii) marine and oil spillage; (iii) livestock waste and dung disposal etc. (c) Effects of land/pond pollution on farmers and agricultural productivity. **C. AGRICULTURAL ENGINEERING/MECHANIZATION** 1. Simple farm tools (a) Meaning of simple farm tools. (b) Types of simple farm tools - cutlass, hoe, spade, shovel etc. (c) General maintenance of simple farm tools. 2. Farm machinery and implements (a) Farm machinery: (i) tractor; (ii) bulldozer; (iii) shellers; (iv) dryers; (v) incubators; (vi) milking machines; (vii) combine harvester etc.	Ways of minimizing land/pond pollution would be assessed. Assessment would include identification, description and uses of each of the tools. Assessment would include the meaning, uses/functions and identification of different parts of each of the farm

(b) Tractor-coupled implements: (i) ploughs; (ii) harrows; (iii) ridgers; (iv) planters; (v) harvesters; (vi) sprayers etc.	machinery and implements. Engineering details are however not required.
3. Maintenance practices and precautionary measures (a) Reasons for maintaining farm machines. (b) Maintenance of farm machinery: (i) check water and oil levels regularly; (ii) carry out routine service; (iii) keep machines clean etc. 4. Agricultural mechanization (a) Meaning of agricultural mechanization. (b) Mechanized agricultural operations. (c) Advantages and disadvantages of agricultural mechanization. (d) Limitations of agricultural mechanization. 5. Prospects of agricultural mechanization 6. Farm power (a) Sources of farm power. (b) Advantages and disadvantages of different sources of farm power. 7. Farm surveying (a) Meaning of farm surveying. (b) Common survey equipment. (c) Uses of farm survey equipment. (d) Maintenance of farm survey equipment. (e) Importance of farm surveying.	Assessment would include precautionary measures in the use of farm machinery. Mechanized agricultural operations: ploughing, harrowing, planting, harvesting, milking etc would be assessed. Possible ways of improving agricultural mechanization such as developing less expensive machines and establishing agricultural engineering schools for personnel would be assessed.

8. Farm planning (a) Meaning of farm planning. (b) Factors to be considered in farm planning. (c) Importance of farm planning.	Engineering details are not required.
9. Principles of farmstead planning (a) Meaning of farmstead. (b) Importance of farmstead planning. (c) Factors to be considered in the design of a farmstead. (d) Farmstead layout. **D. CROP PRODUCTION** 1. Classification of crops (a) Classification of crops based on their uses e.g. cereals, pulses, roots and tubers, vegetables. (b) Classification based on their life cycle e.g. annual, biennial, perennial, ephemeral. (c) Classification based on their morphology e.g. monocotyledonous and dicotyledonous crops. 2. Husbandry of selected crops:- botanical names and common names of the crop, varieties/types, climatic and soil requirements, land preparation, methods of propagation, planting date, seed rate, spacing, sowing depth and nursery requirements, cultural practices: supplying, thinning, manuring and fertilizer requirement and application, weeding, pests and disease control, harvesting, processing and storage of at least one representative crop from each of the following crop groupings: (a) Cereals e.g. maize, rice, guinea corn, millet; (b) Pulses (grain legumes) e.g.	Assessment would cover site selection, location of structures and sketching of farm layout. A general knowledge of husbandry of all the crops listed is presumed.

cowpea, soya bean, pigeon pea.	
(c) Roots and tubers e.g. cassava, yam, potatoes; (d) Vegetables e.g. tomatoes, onion, amaranthus, okro, cauliflower, spinach; (e) Fruits e.g. citrus, banana, pineapple; (f) Beverages e.g. cocoa, tea, coffee; (g) Spices e.g. pepper, ginger; (h) Oils e.g. groundnut, sheabutter, sunflower, oil palm; (i) Fibres e.g. cotton, jute, sissal hemp; (j) Latex e.g. rubber; (k) Others – sugar cane etc. 3. Pasture and forage crops (a) Meaning of pasture and forage crops. (b) Uses of forage crops. (c) Types of pasture. (d) Common grasses and legumes used for grazing livestock. (e) Factors affecting the distribution and productivity of pasture. (f) Establishment of pasture. (g) Management practices of pasture. 4. Crop improvement (a) Aims of crop improvement. (b) Methods/processes of crop improvement e.g. introduction, selection, breeding. (c) Mendel's laws of inheritance. (d) Advantages and disadvantages of crop	Assessment would include the botanical names and characteristics of common grasses and legumes used for grazing livestock. Assessment would include the meaning of crop improvement. Definition of some genetic terms: characters or traits, chromosomes, genes, Mendel's 1st and

improvement. **E. FORESTRY** 1. Forest management (a) Meaning of forest and forestry. (b) Importance of forestry. (c) Forest regulations. (d) Forest management practices. (e) Implications of deforestation.	2nd laws would be assessed.
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2. Agro-forestry practices in West Africa (a) Meaning of agro-forestry. (b) Agro-forestry practices: (i) taungya system; (ii) alley cropping; (iii) ley farming etc. **F. ORNAMENTAL PLANTS** 1. Meaning and importance of ornamental plants (a) Meaning of ornamental plants. (b) Importance of ornamental plants. 2. Common types of ornamental plants (a) Types of ornamental plants according to their uses: (i) bedding plants (mostly flowering plants); (ii) hedging plants; (iii) lawn grasses etc. (b) Examples of ornamental plants. 3. Settings and location for planting ornamental plants. 4. Methods of cultivating ornamental plants: (i) by seed;	Common tree species suitable for agro-forestry practices would be assessed. Assessment would cover identification of various types of ornamental plants. The common and botanical names would be assessed.

(ii) vegetative propagation. 5. Maintenance of ornamental plants. **G. CROP PROTECTION** 1. Diseases of crops (a) Meaning of disease (b) General effects of diseases on crop production. (c) Disease: causal organism, economic importance, mode of transmission, symptoms, prevention and control	Importance of each method and examples of ornamental plants propagated through such method would be assessed. Reasons for carrying out maintenance operations: watering, mulching, pruning etc would be assessed.
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measures of the diseases of the following crops: (i) cereals – smut, rice blast, leaf rust etc; (ii) legumes – cercospora leaf spot, rosette etc; (iii) beverages – cocoa blackpod, swollen shoot, coffee leaf rust etc; (iv) tubers – cassava mosaic, bacterial leaf blight etc; (v) fruits- citrus gummosis, dieback etc (vi) fibre – black arm/bacterial blight of cotton etc; (vii) vegetables – root knot of tomato or okro, damping off, onion twister etc; (viii) stored produce – mould etc. 2. Pests of crops (a) Meaning of pests. (b) Classification of pests: (i) insect-pests; (ii) non-insect pests. (c) Classification of insect-pests based on mouth parts with examples: (i) biting and chewing; (ii) piercing and sucking;	Assessment would include at least two fungal, two viral, two bacterial and one nematode diseases of the crops chosen from the list.

(iii) boring. (d) Important insect-pests of major crops; field and storage pests, life cycle, economic importance, nature of damage, preventive and control measures of the following major insect-pests of crops: (i) cereals – stem borer, army worm, ear worm etc;	
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(ii) legumes – pod borer, aphids, sucking bugs and leaf beetle; (iii) beverages – cocoa myrids (capsids); (iv) tubers – yam beetle, cassava mealybugs, green spidermites, variegated grasshopper; (v) fibre – cotton stainer, bollworms; (vi) fruits and vegetables – thrips, grasshopper, leaf roller, leaf beetle, scale insect; (vii) stored produce – grain weevils, bean beetle. (e) Non-insect pests e.g. birds, rodents etc. (f) Side effects of preventive and control methods: (i) chemical – pollution, poisoning; (ii) biological - disruption of the ecosystem etc; (iii) cultural – harmful effects of burning etc. (g) General effects/economic importance of pests. 3. Weeds (a) Meaning of weeds. (b) Types of weeds.	Nature of damage, economic importance, preventive and control measures of each of the

(c) Effects of weeds on crops and economy. (d) Characteristic features of weeds. (e) Methods of controlling weeds: cultural, biological, chemical, physical and mechanical methods.	non-insect pests would be assessed Common and botanical names would be assessed.

H. ANIMAL PRODUCTION	
1. Types and classification of farm animals (a) Types of farm animals: cattle, sheep, goat, poultry, pig, rabbit, fish etc. (b) Classification of farm animals according to: (i) habitat – terrestrial and aquatic. (ii) uses – food, protection, pet etc.	
2. Anatomy and physiology of farm animals	
(a) Parts of farm animals.	Drawing and labeling of parts of farm animals would be assessed**.**
(b) Organs of farm animals e.g. heart, liver, lungs.	Identification of important organs and their functions would be assessed.
(c) Systems of farm animals e.g. digestive system, circulatory system, respiratory system.	
3. Animal reproduction (a) Meaning of reproduction. (b) Roles of hormones in reproduction of farm animals. (c) Reproductive systems of farm animals. (d) Processes of reproduction in farm animals. (e) Egg formation in poultry.	Assessment would include the digestive system of poultry, differences between the monogastric and ruminant digestive systems**.**
4. Environmental physiology (a) Meaning of environmental physiology. (b) Effects of changes in climatic factors such as: (i) temperature; (ii) relative humidity; and (iii) light on: growth, reproduction, milk production, egg production etc.	Assessment would include oestrus cycle, heat period, mating, gestation period, parturition, lactation, colostrum, mammary glands, signs of heat, ovulation etc.

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5. Livestock management (a) Meaning of livestock management. (b) Requirements for livestock management: housing; feeding; hygiene and finishing of at least one ruminant and one non-ruminant from birth to market weight. (c) Importance of management practices.	Assessment would include extensive, intensive and semi-intensive systems of management and record keeping in livestock management.
6. Animal nutrition (a) Meaning of animal nutrition. (b) Classification of feeds. (c) Sources and functions of feed nutrients. (d) Types of ration/diet and their uses; components of a balanced diet, production and maintenance rations. (e) Causes and symptoms of malnutrition and their correction in farm animals.	The biochemical details of the nutrients are not required. Assessment would include the types of diet for the various classes of animals, their characteristics and supplementary feeding. Assessment would include malnutrition related conditions such as ketosis, rickets.
7. Rangeland and pasture management (a) Meaning and importance of rangeland/pasture to livestock and the characteristics of range land. (b) Common grasses and legumes in rangeland. (c) Factors affecting the level of production of herbage; rainfall, grass/legume composition, grazing etc. (d) Methods of rangeland and pasture improvement: controlled stocking, rotational grazing, use of fertilizers, introduction of legumes, reseeding, weed control, burning, pest and disease control.	

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8. Animal improvement (a) Meaning of animal improvement. (b) Aims of animal improvement. (c) Methods of animal improvement: (i) introduction; (ii) selection; (iii) breeding. (d) Artificial insemination. (i) meaning of artificial insemination. (ii) methods of collecting semen. (iii) advantages and disadvantages of artificial insemination.	Assessment would include differences and similarities between breeds (local, exotic and cross/hybrid) and performance of animals.
9. Animal health management (a) Meaning of disease. (b) Causal organisms: viruses, bacteria, fungi and protozoa. (c) Factors that could predispose animals to diseases: health status of animals, nutrition, management etc. (d) Reaction of animals to diseases: susceptibility and resistance to diseases. (e) Causal organisms, symptoms, mode of transmission, effects, prevention and control of the following selected livestock diseases: (i) viral-foot and mouth, rinderpest, newcastle; (ii) bacterial – anthrax, brucellosis, tuberculosis; (iii) fungal – aspergillosis, ringworm, scabies; (iv) protozoa – trypanosomiasis, coccidiosis.	The economic importance of the diseases would be assessed.

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(f) Parasites. (i) meaning of parasite. (ii) types of parasites. (iii) mode of transmission, life cycle, economic importance and control of the following selected livestock parasites: endoparasites – tapeworm, liverfluke and roundworm; ectoparasites – ticks, lice. (g) General methods of prevention and control of diseases and parasites: quarantine, inoculation/immunization, hygiene, breeding for resistance etc. 10. Aquaculture (a) Meaning of aquaculture. (b) Different types of aquaculture: (i) fish farming; (ii) shrimp farming; (iii) crab farming. (c) Meaning and importance of fish farming. (d) Conditions necessary for siting a fish pond. (e) Establishment and maintenance of fish pond. (f) Fishery regulations – meaning and regulations. (g) Fishing methods and tools.	Assessment would include aeration, stocking, feeding, harvesting, processing and preservation of fish.

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11. Apiculture or bee keeping (a) Meaning of apiculture or bee keeping. (b) Types of bees: (i) indigenous bees; (ii) exotic bees. (c) Importance of bee keeping. (d) Methods of bee keeping: (i) traditional method; (ii) modern bee keeping. (e) Bee keeping equipment: bee hives, hive tools like suits, smokers, jungle boots, brushes etc. (f) Precautionary measures in bee keeping: (i) locate apiaries far from human dwellings; (ii) put warning symbols near apiary etc.	
I. AGRICULTURAL ECONOMICS AND EXTENSION	
1. Basic economic principles: (a) scarcity; (b) choice; (c) scale of preference; (d) law of diminishing returns.	
2. Factors of production: (a) land; (b) capital; (c) labour – characteristics and classification; (d) management or entrepreneur.	
3. Principles of demand (a) Definition of demand.	Rural-urban migration and how it affects labour availability in agricultural production would be

(b) Law of demand. (c) Factors affecting demand for agricultural produce.	assessed.

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(d) Movements along the demand curve. (e) Shifts in the demand curve. 4. Principles of supply (a) Definition of supply. (b) Law of supply. (c) Movements along supply curve. (d) Shifts in the supply curve. (e) Factors affecting the supply of agricultural produce. 5. Implications of demand and supply for agricultural production (a) Price support. (b) Price control. (c) Subsidy programme and its effects on agricultural production. 6. Functions of a farm manager (a) Meaning of a farm manager. (b) Functions of a farm manager. 7. Problems faced by farm managers 8. Agricultural finance (a) Meaning of agricultural finance. (b) Importance of agricultural finance. (c) Sources of farm finance. (d) Classes of farm credit: (i) classification based on length of time: - short-term credit; - medium term credit; - long-term credit. (ii) classification based on source of	Assessment would include the meaning of farm management

credit: - institutional credit; - non-institutional credit. (iii) classification based on liquidity: - loan in-cash; - loan in-kind.	
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(e) Problems faced by farmers in procuring agricultural credit. - high interest rate; - lack or inadequate collateral etc. (f) Problems faced by institutions in granting loans to farmers: -lack of records and accounts etc. (g) Capital market. (i) meaning of capital market, institutions that deal with medium and long term loans for agricultural business. (ii) institutions involved in the capital market (iii) sources of funds for the capital market: - bonds; - insurance companies; - merchant banks; - the stock exchange (sales and purchases of shares). (iv) roles of capital markets in agricultural business: - mobilization of long term funds for on-lending; - reduce over reliance on money market etc. 9. Farm records and accounts	Assessment would include the meaning of agri-business.

(a) Importance of farm records. (b) Types of farm records: (i) inventory records; (ii) production records; (iii) income and expenditure records; (iv) supplementary or special records. (c) Designing farm records	
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(d) Farm accounts: (i) expenditure/ purchases account; (ii) income/sales account; (iii) profit and loss account; (iv) balance sheet. 10. Marketing of agricultural produce (a) Meaning and importance of marketing of agricultural produce. (b) Marketing agents and their functions. (c) Marketing functions: (i) assembling; (ii) transportation; (iii) processing etc. (d) Marketing of export crops. (e) Export crops in West Africa. (f) Guidelines for exporting crops in West Africa. (g) Corporate bodies, cooperative societies and individuals engaged in exporting agricultural produce e.g ANCE - Association of Nigerian Cooperative Exporters. (h) Importance of exporting agricultural produce. (i) Problems of marketing	Assessment would include terms such as salvage value, appreciation, farm budget, depreciation, inventory, their importance and their uses in calculating profit and loss of farm items like crops, livestock, farm machinery and tools in the farm. Advantages and disadvantages of the marketing agents would be assessed.

agricultural produce . 11. Agricultural insurance (a) Meaning of agricultural insurance. (b) Importance of agricultural insurance. (c) Types of insurance policies for agricultural production: (i) specific enterprise insurance e.g. crop insurance, livestock insurance;	
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(ii) farm vehicle insurance; (iii) fire disaster insurance or machines and buildings insurance; (iv) life assurance (farmers, farm workers and farmers' household). (d) Insurance premium (e) Problems of agricultural insurance: - uncertainties of weather; - losses due to natural disaster etc. 12. Agricultural extension (a) Meaning and importance of agricultural extension (b) Agricultural extension methods: (i) individual contact methods; (ii) group contact methods etc. (c) Agricultural extension programmes in West Africa e.g ADP, NDE, Agro-service centres, state ministries of agriculture and natural resources (d) Problems of agricultural extension in West Africa. e.g. illiteracy among farmers, inadequate transport facilities etc.	Qualities of a good extension worker would be assessed.

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PRACTICAL AGRICULTURAL SCIENCE **A. AGRICULTURAL ECOLOGY** 1. Soil	Soil samples are to be examined for texture by manual feeling of wet and dry soil. Examination of fertile and infertile soils and note distinguishing features of soils – colour, texture and structure, presence of organic matter and living things.
2. Soil profile	Simple description and identification of soil profile would be assessed.
3. Rocks	Identification of common rock types: igneous, sedimentary and metamorphic would be assessed.
4. Laboratory work on physical properties of soil. (a) Mechanical analysis by sedimentation and also by use of hydrometer method or sieves (b) Determination of bulk density and total pore space. (c) Determination of moisture content of	

a moist soil sample. (d) Determination of maximum water holding capacity. (e) Determination of wilting point. (f) Determination of capillary action. 5. Laboratory work on chemical properties of soil. (a) Determination of soil acidity using pH meter and/or any other gadget or simple equipment. (b) Common types of chemical fertilizers.	Identification, methods and rates of application of nitrogen, phosphorus, potassium and compound fertilizers would be assessed.
(d) Organic manure: (i) green manure; (ii) farm yard; (iii) compost. 6. Irrigation and drainage **B. AGRICULTURAL ENGINEERING/MECHANIZATION** 1. Farm tools and equipment 2. Tractor and animal drawn implement	Identification, method of preparation and application of compost would be assessed. Identification and uses of irrigation and drainage equipment e.g. watering can, sprinkler, pump, pipes would be assessed. Assessment would include identification, description, uses and maintenance of various garden tools and equipment e.g. hoe, cutlass, garden trowel, hand fork, shovel, spade, rake, sickle, secateurs, shears, long handle hoe, pruner, budding knife, emasculator. Assessment would include identification, description, uses and maintenance of tractor and animal-drawn implements e.g. ploughs, harrows, ridgers, planters, cultivators; identification of the

3. Harvesting, processing and storage equipment. 4. Farm tractor 5. Uses and maintenance of horticultural tools and implements. 6. Livestock and fishing equipment	major parts of the implements and their functions. Assessment would include identification, description and uses of harvesting, processing and storage equipment e.g. dehuskers, shellers, winnowers, dryers, processors, graters, refrigerators, cutlasses, scythe, groundnut lifters. Identification of the major components of the farm tractor, servicing and maintenance would be assessed. Identification, uses and maintenance of the following horticultural tools: shears, dibber, pruning knife, secateurs, budding knife, measuring tapes, hand fork, hand trowel, hoe, fork would be assessed. Identification, description, uses and care of livestock and fishing equipment e.g. waterers, feeders, milking machines, nets, hook and line, branding machine, egg candler would be assessed.
7. Farm surveying equipment **C. CROP PRODUCTION** 1. Seeds, seedlings, fruits and storage organs of crops. 2. Main pests and diseases of crops	Assessment would include identification, uses, and care of simple surveying equipment e.g. measuring tape, pins or arrows, ranging poles, plum bob, offset staff, compass, gunter's chains, pegs, theodolite. Identification of seeds, seedlings, fruits, storage organs and essential parts of the common crop plants, pasture grasses and legumes would be assessed. Assessment would include

	identification and control of the main field and storage pests e.g. cotton stainer, yam beetles, weevils etc and the damage they cause to crops; identification of main diseases of crops, their causal agents and characteristic symptoms, prevention and control.
3. Planting dates, seed rates, plant population and seed quality tests of the more common local crop plants.	
4. Preparation of seedbeds, fertilizer application, mulching, use of pesticides , watering, vegetative propagation, germination tests etc.	
5. Forest products and by-products.	
6. Methods of propagation of horticultural plants.	Assessment would include the following propagation methods – direct sowing, transplanting, layering, grafting and budding.
7. Common weeds	External features, mode of dispersal and methods of controlling weeds on the farm would be assessed.
D. ANIMAL PRODUCTION	
1. Common breeds of animals and types of animals available in the locality.	Identification of breeds, methods of restraints, handling and grooming of farm animals would be assessed.
2. Major internal organs of farm animals, e.g. organs of the digestive system, reproductive and excretory systems.	Assessment would cover identification and functions of the major internal organs.
3. Animal by-products	Identification of animal by-products e.g. hides and skin, fur, feather, horn would be assessed.
4. Animal feeds and feed stuffs and their local sources.	Assessment would cover the identification and uses of feeds and feed stuffs(e.g. fish meal, groundnut cake, rice bran); types of diets/ration.
5. Main pests and parasites of farm animals.	

6. Diseases of farm animals. 7. Routine management practices in farm animals, e.g. selection of livestock and poultry for breeding, culling, ear-notching, tattooing, horn or skin branding, debeaking, dehorning, castration. 8. Fish harvesting and preservation.	Assessment would cover identification of common ectoparasites(e.g. ticks, lice) and endoparasites(e.g tapeworms, liver flukes, roundworms); the damage caused on their hosts and their control; and their life cycles. Methods of prevention and control of diseases of farm animals, e.g. drugging, drenching, dipping, spraying and simple methods of farm sanitation would be assessed. Assessment would cover the identification of equipment/tools used for routine management practices. Methods of harvesting, processing and preservation of fish would be assessed.