Marking Scheme – II
Agriculture (Theory)
Class XII (2016 – 17)

Time duration: 3 Hrs **Maximum Marks: 70**

<table>
<tr><td>1.</td><td>This law states that, “the level of plant production cannot be greater than that allowed by the most limiting of the essential plant growth factors”. In other words, the law states growth is controlled by the scarcest resource which is the limiting factor.</td><td>1</td></tr>
<tr><td>2.</td><td>Post-harvest technology is inter-disciplinary "science and technique" applied to horticultural/agricultural produce immediately after harvest for its protection, conservation, processing (cooling, cleaning, sorting), packaging, distribution, marketing, and utilization to meet the food and nutritional requirements of the people in relation to their needs.</td><td>1</td></tr>
<tr><td>3</td><td>Swarming is the process by which a new honey bee colony is formed when the queen bee leaves the colony with a large group of worker. In the prime swarm, about 60% of the worker bees leave the original hive location with the old queen.</td><td>1</td></tr>
<tr><td>4</td><td>Cities and metropolis are densely populated. The most common problem is air, dust and noise pollution. Trees with their huge canopy minimize these pollutions by filtering dust and absorption of gaseous pollutants. Parks and tree canopies help reduce noise, stress , blood pressure and improves quality of life of people living around it.</td><td>1</td></tr>
<tr><td>5</td><td>Nosema disease (Nosemosis)</td><td>1</td></tr>
<tr><td>6.</td><td>
<table>
<tr><td>S. No.</td><td>Macronutrients</td><td>Micronutrients</td></tr>
<tr><td>1</td><td>Macronutrients are required in large quantities.</td><td>Micronutrients are required in relatively smaller quantities.</td></tr>
<tr><td>2</td><td>These include C, H, O, N, P, K, Ca, Mg and S.</td><td>These include Fe, Mn, Zn, Cu, B, Mo, Cl and Ni.</td></tr>
<tr><td>3</td><td>Primary nutrients are N, P and K.</td><td>Micronutrient cations are Fe, Mn, Zn, Cu and Ni.</td></tr>
<tr><td>4</td><td>Primary nutrients are Ca, Mg and S.</td><td>Micronutrient anions are B, Mo and Cl.</td></tr>
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</td><td>2</td></tr>
<tr><td>7.</td><td>The Criteria of essentiality as proposed by Arnon and stout (1939) includes the following.
a. A deficiency of an essential nutrient element makes it impossible for the plant to complete its life cycle.
b. The deficiency is specific to the element and can be corrected only by supplying that element.
c. The element plays a direct role in the metabolism and nutrition of the plant.</td><td>2 (Any two)</td></tr>
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8	Reasons behind the use of thermal processing during food processing and preservation are a) Inactivation of enzymes to check biochemical reaction like ripening. b) To kill microorganism as most of them are killed in the range 82-93°C. Spores are not destroyed even at 100°C for 30 min. Therefore, to ensure sterility (total microbial destruction, including spores), a temperature of 121°C must be maintained for 15 min or longer.	1 x 2 = 2
9	Main objective of packaging the processed foods are (i)It helps in safe and ease in transportation, storages, marketing and distribution of produce. (ii) It provides physical protection to processed food as well as from microorganisms and adverse weather condition. (iii) It can also be used to advertise the product.	1 x 2 = 2
10.	*Vermicomposting* is the process of turning organic debris into worm castings. The worm castings are very important to the fertility of the soil. The castings contain high amounts of nitrogen, potassium, phosphorus, calcium, and magnesium. Castings contain: 5 times the available nitrogen, 7 times the available potash, and 1 ½ times more calcium than found in good topsoil **Advantages of vermicompost** • Vermicompost is rich in all essential plant nutrients. • Provides excellent effect on overall plant growthVermicompost is free flowing, easy to apply, handle and store and does not have bad odour. • It improves soil structure, texture, aeration, and waterholding capacity and prevents soil erosion. • Vermicompost is free from pathogens, toxic elements, weed seeds etc. • Vermicompost minimizes the incidence of pest and diseases. • It enhances the decomposition of organic matter in soil.	1+1=2
11.	a. The components of Integrated Pest management are as follows: • Cultural Control • Natural Control • Host Plant Resistance • Pest Surveillance • Physical methods • Mechanical Control • Chemical Control • Biological Control • Legal control b. Mechanical method of pest management envisages use of mechanical devices and manual forces for the destruction of pests. Different life stages of the insects are killed by manual or mechanical forces. Examples for use of manual force: 1. Hand picking of caterpillars 2. Sieving and winnowing for red flour beetle. Examples for use of mechanical force: 1. Use of tillage implements for exposing the soil borne insects.	(Any four) 1 2

	2. Use of mechanical traps like rat traps for rat exclusion. Examples for Mechanical exclusion: 1. Banding with grease on mango trunk to prevent mealy bug 2. Wrapping the pomegranate fruits for controlling fruit borer. Advantages of mechanical method of pest management: 1. Low cost of equipment 2. High technical knowledge and skill are not required. Limitations of mechanical method of pest management: 1. Labour intensive 2. Limited application c. **Biological control** The study and utilization of parasitoids, predators and pathogens for the regulation of pest population densities is called as biological pest control. The techniques adopted for biological control are as follows: 1. Conservation and encouragement of indigenous natural enemies 2. Introduction of natural enemies into a new locality 3. Mass culturing and release of natural enemies to increase its population. **Parasitoids as a biocontrol:** Parasitoid is an insect parasite of an arthropod which is parasitic in immature stages and adults are free living. e.g. 1.*Trichogramma chilonis* on the eggs of sugarcane internode borer, cotton bollworm. 2. *Chelonus blackburni* on the eggs of cotton spotted bollworm. **Predators as a biocontrol:** Predator is a free living organism throughout its life. Predator kills its prey. The predator is usually larger than its prey. e.g. 1.Lady bird beetle (*Coccinella septumpunctata*) against aphids (pest). 2. Reduviid bug (*Rhinocoris fuscipes*) against cotton American bollworm (*Helicoverpa armigera*) (pest)	2
12.	**BORON** Boron is absorbed by plants as boric acid (H_3BO_3). **Functions of boron:** 1. Boron is responsible for cell wall formation and stabilization, lignification and xylem differentiation. 2. It plays an important role in pollen germination and pollen tube growth. 3. It imparts drought tolerance. 4. It facilitates transport of potassium in guard cells and also aids in stomatal opening. 5. Nodule formation in legumes **Deficiency symptoms of Boron:** 1. Deficiency Symptoms are observed on the terminal buds or youngest leaves. 2. Flowering and fruit development are restricted. 3. Sterility and mal formation of reproductive organs. 4. Thickened and curled leaves.	5

	5. Discoloration, cracking or rotting of fruit, tubers or roots 6. Internodes become shorter and give a rosette appearance. 7. Boron deficiency symptoms occur as internal cork of apple, top sickness of tobacco, heart rot of sugarbeet, etc. **MOLYBDENUM** Molybdenum is absorbed by plants as molybdate (MoO_4). **Functions of Mo:** 1. Biological nitrogen fixation is catalyzed by the molybdenum containing enzyme nitrogenase. 2. Nitrate is reduced by the nitrate reductase enzyme present in the cytoplasm by the transfer of electrons from molybdenum to nitrate 3. It affects the formation of pollens, viability of pollens and development of anthers. 4. It is involved in the protein synthesis. **Deficiency symptoms of Mo:** 1. Flower formation is inhibited. 2. Chlorotic mottlings between the veins on old or middle leaves. 3. Reduce activity of symbiotic and non-symbiotic N fixation. 4. In case of cauliflower, molybdenum deficiency symptom is called as whip tail.	
13.	**<u>Method of pre-cooling</u>** : i. Room cooling ii. Forced air cooling iii. Hydrocooling iv. Vacuum cooling v. Package icing ***<u>Description any two:</u>*** i) *<u>Room cooling</u>*: It is low cost and slow method of cooling. In this method, produce is simply kept into a cool room and cool air is allowed to circulate. <u>Advantages</u>: a) Produce can be cooled and stored at the same room thus saves on handling costs. b) No extra cost for pre-cooling equipment. c) Suits for crops, which are marketed soon after harvest. <u>Disadvantages</u>: a) It is too slow method of cooling b) Space requirements for room cooling are more as compared to storage, thus loss of storage capacity. c) Excessive water is lost from the produce due to slow cooling. Horticulture crops suitable for rooms cooling are: Potato, onion, apple and citrus ii) *<u>Forced-air cooling</u>*: Forced air-cooling is mostly used for wide range of horticultural produce and it is fastest method of pre-cooling. Forced air-cooling pulls or pushes air through the vents/holes in storage containers. In this method uniform cooling of the produce can be achieved. <u>Advantages</u>: a) Fast method of pre cooling b) Suitable for wide range of highly perishable commodities.	1 2X2=4

	c) Uniform cooling, if containers are properly aligned. Horticultural produce suitable for forced air cooling are: Grapes, Berries, Pears, Peach, Oranges, Strawberries tomato, and other tropical and subtropical fruits. iii) *Hydrocooling* : The use of cold water is an old and effective cooling method used for quickly cooling a wide range of fruits and vegetables before packaging. This method of cooling not only avoids water loss but may even add water to the commodity. Advantages : a) Less energy is used as compared to forced air cooling. b) Moisture loss does not take place. Disadvantages : a) Most of the packages don't tolerate wetting. b) Wax layer of some fruits like pear, plum, apple are removed by using spray type of hydrocooler Horticultural produce suitable for hydrocooling are: Mango, peach, asparagus etc. iv) *Vacuum cooling*: Vacuum cooling take place by water evaporation from the product at very low air pressure. In this method, air is pumped out from a larger steel chamber in which the produce is loaded for pre-cooling. Removal of air results in the reduction of pressure of the atmosphere around the produce, which further lowers, the boiling temperature of its water. As the pressure falls, the water boils quickly removing the heat from the produce. Advantages : a) Packed produce can be cooled if the pack allows moisture transfer. b) Fast and uniform cooling takes place. c) Most energy efficient method. Disadvantages : a) High initial capital cost b) Produce losses more moisture To overcome the more loss of water from the produce, v) *Package-icing*: In some commodities, crushed or flaked ice is packed along with produce for fast cooling. However, as the ice comes in contact with the produce, it melts, and the cooling rate slows considerably. The ice keeps a high relative humidity around the product. Package ice may be finely crushed ice, flake ice or slurry of ice. Liquid icing distributes the ice throughout the container, achieving better contact with the product. Precaution: Packaged icing can be used only with water tolerant, non-chilling sensitive products and with water tolerant packages (waxed fiberboard, plastic or wood).	
14	Storage and upkeep of fruits and vegetables are most important post harvest activity. Zero energy cool chamber (ZECC) is a low cost alternative to store horticulture produce. This is an on-farm storage chamber, for fresh fruits, vegetables and flowers to extend their marketability. The zero energy cool chamber can be constructed easily with materials like brick, sand, bamboo, khashkhas/straw, gunny bag etc. The chamber can keep the temperature 10-15^{0}C cooler than the outside	3

	temperature and maintain about 90% relative humidity. It is most effective during the dry season. **<u>Reason for popularity in rural areas</u>** Due to lack of sufficient storage and processing facilities in rural areas, considerable amount of fruits and vegetables are being spoiled after harvest. The spoilage of fruits and vegetables can be controlled by reducing the storage temperature and increasing relative humidity. Refrigerated cold storage is considered to be the best for storing fruits and vegetables, but this method is not only highly energy intensive, but also requires huge capital investment. Besides, it is not suitable for on-farm storage in rural areas, where the producer would like to store the commodities only for a couple of days in order to make it sufficient quantities before carrying them to nearest market. Considering acute energy shortage and inadequate cold storage facilities in rural areas, low cost "Zero Energy Cooling Chamber" is very popular for short term on farm storage of perishable farm produce. Also they are easy to build out of locally available materials, such as brick, sand, bamboo, straw, and gunny bags and can be constructed by an unskilled person and no mechanical or electrical energy is needed for its functioning.	2
15(a)	1. Mother Plants: Area fixed for mother plants is an important part for developing a nursery. The mother plants must be true to the type and true to the variety. 2. **Pot Nursery**: Are where pots are kept and sored. 3. **Poly bag nursery**: The propagated plants are planted in nursery beds for better growth or hardening the plants. In general, this type of nursery bed is prepared under partial shade 4. Ball Nursery including beds: Ball Nursery including beds of 100 m x 55 m dimension with smaller seed beds. 5. **Workshed**: The workshed of 6 m x 4.5 m with thatch roofs and locally available materials like bamboo, wood, etc. may be constructed. 6. **Polyhouse**: The polyhouse of 9 m x 4 m dimension with 90 cm, brick wall, 3.6 m tall rhombus netting with expanded metal and polythene roof supported by local materials like bamboo, wood and planks, may be constructed. 7. **Store-cum-office**: A store-cum-office of 6.0 m x 4.5 m constructed with locally available materials may serve the purpose.	3

Space allotment	Sq. m.
Mother Plants	560
Pot Nursery	200
Polybag Nursery	350
Ball Nursery including beds	550
Workshed	27
Polyhouse	36

	Store cum office | 27 Total | 1750 15% additional for passage, drainage, etc. | 260 Grand Total | 2010	
(b)	While packing plants the container is neither over-packed nor loose enough allowing the contents to move about. All space should be filled up by some packing materials like straw, dried grass, etc. For long distance destinations, the ball of earth should be soaked in water and covered with a thick layer of wet moss. Only plants having a well-developed root system should be selected for such destinations. Marketing of plants and planting materials is the most crucial and important part of the nursery business. The production of high quality true to the type and attractive planting materials is absolutely necessary. They must be free from pests and diseases and vigorously growing.	2
16.	a. What is organic farming? Organic farming is an agricultural production system that sustains the soil health, agro-ecosystems and human beings. Organic farming relies immensely on ecological principles, agro-biodiversity and bio-geochemical cycles adapted to local conditions, rather than use of inputs which cause adverse impacts. It intensely combines traditional knowledge, innovation and science to benefit the shared environment and promote fair relationships and a good quality of life for all involved.	2
	b. What is organic certification? Organic certification system is a quality assurance initiative, intended to assure quality, prevent fraud and promote commerce, based on set of standards and ethics. It is a process certification for producers of organic food and other organic plant products.	2
	c. What are the Government policies promoting organic farming in India? The Government policies promoting organic farming in India are the following. 1. National Mission for Sustainable Agriculture (NMSA)/ Paramparagat Krishi Vikas Yojana(PKVY) 2. Rashtriya Krishi Vikas Yojana (RKVY) 3. Mission for Integrated Development of Horticulture (MIDH) 4. National Mission on Oilseeds & Oil Palm (NMOOP) 5. Network Project on Organic Farming of Indian Council of Agricultural Research (ICAR) and 6. National Programme on Organic Production (NPOP) of Agricultural & Processed Food Products Export Development Authority (APEDA).	2
	d. Explain the important characteristics of organic farming. Important characteristics of organic farming are as follows: 1. Sustainable use of local resources.	4

	2. Minimum use of purchased inputs. The purchased inputs are only complementary to the local resources. 3. Ensuring and enhancing the biological functions of soil-water-nutrients continuum. Organic farming practices improve the soil physical, chemical and biological properties of soil. 4. Maintaining the agro-biodiversity to achieve ecological balance and economic stability. 5. Crop diversification is an important component of organic farming systems. Crop diversification helps in improving the soil health and agricultural productivity.	
17 **(a)**	Cut flowers refers to fresh flowers harvested/cut , that have started to blossom or are in the bud stage, which may have branches, stems and leaves to be used for decorations.	2
(b)	*Factors affecting longevity of cut flowers* i. **Genetic factors**(crop specie sand cultivar) ii. **Environmental factors** (Light,-quality, intensity and photoperiod (Most cut flower crops require well-lighted conditions. On the contrary, too high light intensities cause scorching and dropping of leaves and abscission of petals.): Temperature, relative humidity ,air quality, pressure and growing condition iii. **Management factors**: Growing media, nutrition irrigation frequency, fertilizers (High nitrogen doses should be avoided as they increase susceptibility to diseases.), insecticides presence of insect-diseases (Flowers damaged by pathogens, insects and pests also show high ethylene production resulting in poor vase-life.), growth regulators iv. **Harvest factors**: right maturity indices (Harvesting of flowers at bud stage is always preferred as their buds have long vase-life, are less sensitive to ethylene, easy to handle during storage and transport and are less prone to diseases and pests.), time of harvesting (The best time is the coolest part of the day and when there is no surface water from dew or rain on the plants.), method of harvesting (The stems should be cut with sharp knives or secateurs. Hardwood stems should always be given slanting cut to expose maximum surface are to ensure rapid water absorption.), distance from the market (Materials for preserving usually are harvested more mature than those for fresh, wholesale markets.), consumer preferences v. **Post Harvest Factors :** Water relation **(**The vase life of the harvested flowers depends on water uptake. The rate of water uptake of cut flowers depends on transpiration pull, temperature and composition of solutes . Acidification of water and addition of wetting agent and flower food in the holding solution markedly improve water uptake of cut flowers.), Respiration (The rate of respiration depends on quantity of carbohydrates available in the harvested flowers, temperature and the use of certain chemicals to regulate it. With higher temperature, there is faster rate of respiration and burning of the tissue. Consequently, the life of flowers is	5

	shortened.), Relative humidity and air composition (It has, bearing on the transpiration rate. Higher the humidity in the air, less is the transpiration rate and vice-versa. Increased level of CO_2 and decreased levels of O_2 in the atmosphere prevents build-up of endogenous ethylene), Growth regulators (Postharvest life of flowers can be controlled by growth regulators. Cytokinins delay senescence of some cut flowers. Depending upon the concentrations, GA in some cases promotes longevity of flowers, while this is also used in bud opening solution. Flowers can be stored for a longer period at low temperature. The controlled atmosphere reduces respiration rates, conservation of respirable substrates during, storage, and delay in ethylene-triggered changes, Packing and transporting (Packaging ensures garden fresh of flowers to the consumers. Before packing, flowers should be dried, treated with systemic insecticides and miticides Packing must ensure protection of flowers against physical damage, water loss and external conditions detrimental to transported flowers. Boxes made of corrugated fibre boards (CFB) are good.	
(c)	Cut flowers or cut inflorescence is composed of many morphological units such as sepals, petals, androecium, gynoecium, stem and often leaves. These are different in terms of morphological and physiological traits and interact with each other thus making a cut flower more complex organ. These interactions between these components influence water balance, thus, post harvest life of cut flowers is much affected. About 50% losses occur during post harvest handling so; proper care should be taken during post harvest handling. An ideal cut flower should remain fresh with respect to its colour, fragrance and appearance without loosing its grade for reasonable length of time. **<u>Post harvest handling of cut flowers</u>** i. **Hardening**: It is treatment given immediately after the harvesting of flowers by using water (preferably warm de-ionized water containing some germicide) to restore turgidity. ii. **Pulsing or loading**: It consists of placing the lower portion of cut flower stems in solution containing high percentage of sugar and germicide fo a period of few hours to two days. Specific formulations developed vary with the flower species as sucrose 2-20% for 12-48 hours at 20-27ºC and relative humidity 80-100% under 2000-2500 lux cool light. iii. **Pre -cooling**: it is the removal of field heat from cut flowers, in which temperature is brought down from 25-30 ºC to 1-2 ºC in less than an hour time. Either through hydro cooling or mechanical refrigeration. iv. **Storing cut flowers**: - Cold storage/refrigeration (wet or dry) ➢ Controlled atmospheric storage (CO_2: 5-30%, Temperature: 3-10 ^{0}C, low O_2) ➢ Modified atmospheric storage Hypobaric or low pressure storage (Temperature; 2^{0}C, Relative humidity-98%, Pressure- 24mm Hg or 0.1atm)	3 (Any two)

18	a) **Agro climatic requirement**: In India, button mushrooms are grown seasonally and in environment controlled cropping houses. White button mushroom requires 20-28 ^{0}C for vegetative growth (spawn run) and 12-18 ^{0}C for reproductive growth; relative humidity of 80-90% and enough ventilation during cropping. Seasonally, it is grown during the winter months in the north-west plains of India and for 8-10 months in a year on the hills. However, with the advent of modern cultivation technology it is now possible to cultivate this mushroom anywhere in India. b) **Varieties / Strains:** The strains which are mostly cultivated in India are S-11, TM-79 , Horst H3, Ooty 1 and Ooty (BM) 2. c) **Casing**: The compost beds after complete spawn run should be covered with a layer of soil (casing) about 3-4 cm. thick to induce fruiting. The casing material should have high porosity, water holding capacity and pH 7-7.5. Mixtures like garden loam soil and sand (4:1); decomposed cowdung and loam soil (1:1) and spent compost (2-3 years old); sand and lime are commonly used as casing. The casing soil before application should be either pasteurized (at 66-70 ^{0}C for 7-8 hours), treated with formaldehyde (2%) or steam sterilized. The treatment needs to be done at least 15 days before the material is used for casing. After casing is done the temperature of the room is again maintained at 23-28 ^{0}C and relative humidity of 85-90% for another 8-10 days. d) **Harvesting**: It is done at button stage and caps measuring 2.5 to 4 cm. across are ideal for the purpose. The first crop appears about three weeks after casing. Mushrooms need to be harvested by light twisting without disturbing the casing soil. Once the harvesting is complete, the gaps in the beds should be filled with fresh sterilized casing material and then watered. About 10-14 kg. fresh mushrooms per 100 kg. fresh compost can be obtained in two months crop. e) **Important pest and disease**: The insect pests mostly observed are nematodes and mites. Many diseases like Dry Bubble (brown spot), Wet Bubble (White Mould), Cobweb, Green Mould, False truffle (Truffle disease), Olive green mould, and Bacterial blotch affect mushroom cultivation. Adopt appropriate and timely control measures against pests & diseases to avoid failure of crop.	2+2+2+2 +2=10