

Syllabus for the subject

of

FRUITS AND VEGETABLES PROCESSING

Under

CRAFT INSTRUCTOR TRAINING SCHEME (CITS)

Designed in

- 2014 -

By

**Government of India
Ministry of Labour & Employment
Directorate General of Employment & Training**

GENERAL INFORMATION

1. Name of the Course : Craft Instructor Training
2. Duration of Instructor Training : 1 Year (Two semesters each of six months duration including Vocational calculation and science (V.C.S) and P.O.T (Principle of Teaching).
3. Name of the Subject : FRUITS AND VEGETABLES PROCESSING
4. Examination : AITT to be held at the end of each semester.
5. Space Norms :

Lab Space -	120 Sq. M
Class Room Space -	30 Sq. M
Quality lab-	40 Sq. M
6. Power Norms : 10 Kw.
7. Unit strength(Batch Size) : 20
8. Entry qualification : NTC / NAC from NCVT in fruits and vegetables processing trade **OR** Diploma/Degree in Food Technology/ Food Engineering /Food processing/Post Harvest Management from AICTE recognized Board / University.
9. Trainers' Qualification : Diploma or Degree in Food Technology/Food Engineering/Food processing/Post harvesting management from AICTE recognized Board / University with five / two years experience respectively.

FRUITS AND VEGETABLES PROCESSING**SYLLABUS: FIRST SEMESTER**

Week	Practical	Theory
1-5	<ul style="list-style-type: none">• Handling and operating of food processing equipments such as pulper, sealers, juice extracting machines, autoclaves, corking machines etc.• Instruments such as refractometer, salinometer, Hydrometers, jelmeter, thermometer, vacuum gauge, pressure gauge, seam checking gauge and electronic weighing balance	<ul style="list-style-type: none">• Status and scope of fruits and vegetable industry in India.• Composition and nutritive value of fruits and vegetable.• Factor effecting composition and quality of fruits and vegetables.• Study of various equipments: usage, cleaning methods, care/maintenance and precautions.
6-9	<ul style="list-style-type: none">• Identification of Bacteria, Yeast and mould under microscope.• Preparation and transfer of culture media.• Preparation of slides and use of simple strains.• Quality evaluation of fruits and vegetables.• Quantitative analysis of cut fruits and vegetable yield.• Effects of pre-treatment on quality of cut fruits and vegetables.• Refrigeration storage of fruits and vegetables.• Determination of Maturity indices of fruits & vegetables.	<ul style="list-style-type: none">• Importance of fruits & Vegetables in the diet.• Study of compound Microscope.• Study of bacteria, yeast and mould.• Different types of spoilages in fruits and vegetables.• Spoilage during storage of fruits and vegetables and their prevention.• General methods of preservation of whole fruits/vegetables and processed fruits and vegetables.
10-11	<ul style="list-style-type: none">• Familiarization with laboratory equipments.• Preparation and verification of normality of standard solutions.	<ul style="list-style-type: none">• Definition of Acids, Alkalis, solutions, Titration, pH and salts, their properties etc.• Food additives, Uses of food additives in processing of fruits and vegetables, Function of food additives, Limit of food additives in fruits and vegetables products
12-15	<ul style="list-style-type: none">• Determination of Degree Brix (TSS), pH and % acidity in fruits and vegetable products.• Estimation of benzoic acid, sulphur dioxide and KMS in terms of ppm present in fruits and vegetable products.• Estimation of reducing and non reducing sugars in fruit and vegetable products.	<ul style="list-style-type: none">• Study of Food safety Standards:• HACCP and its benefits and application, ISO 22000.• International food laws and regulatory agencies:• International Organizations – FAO (Food & Agriculture Organization), WHO (World Health Organization), Codex Alimentarius, ISO, WTO.

	<ul style="list-style-type: none"> • Estimation of chloride content in food products. 	<p>National Organizations – ICMR, ICAR, Council for social welfare, International Food Control Systems including CODEX</p> <ul style="list-style-type: none"> • Importance of personal Hygiene, Cleaning & Sanitary standards in Fruits and Vegetable processing industry. • Good Handling Processes (GHP). • Traceability aspects of processed product, Forward and backward traceability.
16-18	<ul style="list-style-type: none"> • Extraction of juice by different methods. • Preservation of fruits juices with addition of preservative. • Preparation of fruit and synthetic beverages. • Preparation of carbonated beverages. 	<ul style="list-style-type: none"> • Technology of extraction of juices from different types of fruits. • Definition of Preservatives, types of preservatives commonly used in Fruits and vegetables processing industry, limits of usage of preservatives. • Fruit beverages: Squashes, syrups, nectars, RTS, crushes, cordial etc. • Technology of carbonated soft drinks.
19-24	<ul style="list-style-type: none"> • Preparation of tomato juices, puree, sauces, ketchups, soup, paste, etc. • Comparison of juice/pulp extraction methods on quality and yield of tomato pulp. • Preparation of jam, jelly and marmalades. • End point determination in preparation of high sugar product. • Preparation of preserves, candies, crystallized and glazed fruits and fruit bars. • Effects of pre-treatment and process variables on quality of preserve and candied fruits. • Preparation of chutney. • Preparation of sauerkraut, gherkins, cauliflower, lime, mango and mixed pickles. 	<ul style="list-style-type: none"> • Tomato products: Manufacturing process of tomato based products like tomato juice, soup, puree, sauce, ketchup, and paste. • Spoilage of tomato products and their preventive measure. • Jams, Jellies and marmalades: selection, preparation, production and preservation. • Difference in between jam and jelly. • Theory of jell formation, failure and remedies in jam and jelly making. • General principles and manufacturing processes of preserves, candied fruits, glazed fruits, crystallized fruits. • Definition of Pickles, chutneys. • Raw materials for preparation of pickles and pickling process.

		<ul style="list-style-type: none">• Spoilage of pickle.• Methods of preparation, curing techniques, defects and remedies in pickle.
25-26	Revision/Examination	

FRUITS AND VEGETABLES PROCESSING**SYLLABUS: SECOND SEMESTER**

Week	Practical	Theory
1-6	<ul style="list-style-type: none">• Drying and dehydration of seasonal fruits and vegetables.• Dehydration and rehydration of common available vegetable.• Different methods of peeling and evaluation of their effectiveness.• Different methods of blanching.• Determination of blanching time.	<ul style="list-style-type: none">• Dehydrated products, Dried Fruits/vegetables slices and dices, Preparation of product for dehydration, Dehydration principles and equipments used for drying.• Spoilage of dehydrated fruits and vegetables.• Sun drying & dehydration and its merits and demerits.• Pre-treatment in drying process.• Effect of dehydration on nutritive value, Packaging of dried Fruits/Vegetables, dried slice and dices.• Principles, merits and limitations of freeze drying.
7-10	<ul style="list-style-type: none">• Blanching test for peroxidase activity.• Physical, chemical and microbiological testing of frozen fruits and vegetables.	<ul style="list-style-type: none">• Freezing principles and its methods, freezing process of fruits and vegetables.• Preparation of fruits/vegetables for freezing, Different method of freezing peas, potato cubes, cauliflower, sprout.• Freezing point of different fruits and vegetables.• Physical and chemical changes during freezing.• Packaging of frozen fruits and vegetables.
11-16	<ul style="list-style-type: none">• Practical demonstration of Bottling, canning and form fills and seal machines.• Formation and examination of can.• Cleaning and maintenance of the equipments.• Examination of the tetra pack.• Demonstration of packaging evaluations.• Testing of packaging materials.	<ul style="list-style-type: none">• Packaging and function of packaging.• Types of packaging materials e.g. paper, glass, metal, plastic.• Packaging requirements and their selection for various process e.g. canning, dehydration etc.• Study of various types of containers like Glass, Tin, Tetra pack, PET bottle: merits and demerits.• Labelling type and its importance, Function and regulations of package labelling.

		<ul style="list-style-type: none"> • Packaging evaluation for WVTR, GTR, Bursting strength, tensile strength, tearing strength, drop test.
17-24	<ul style="list-style-type: none"> • Canning of peaches, apple, strawberries, cherries , pears, plum and pineapple, peas, tomato, corn, spinach, green beans etc. • Cut out analysis • Identification of different lacquers and defects in cans. • Testing of brine and syrups. • Examination of canned food. • Determination of iron content in canned foods. • Analysis of canned and processed products available in the market. • Visit to canning industry. 	<ul style="list-style-type: none"> • General principle of fruits and vegetables canning, type of cans, Types of lacquer. • Lacquering precautions in canning operations. • Equipment for canning. • Unit operation in canning of fruits and vegetables. • Preparations of syrup and brines, Spoilage of canned foods, discolorations and corrosion. • Defects in canned products and lacquers. • Utilization of By-products of fruits and vegetable industry.
25-26	Revision/Examination	

List of Tools and equipments		
Sl. No	Name of Item	Quantity
1.	Complete Canning line capacity upto 5kg/hr including conveyor or elevators	01 no
2.	Baby Boiler coil type, Fuel light oil, force circulation 3 pass design Capacity of steam output 100kg/hr, fuel firing automatic, Electric supply AC,3 PH, 415 V,50HZ,4 Wire system, Qualified attended not required.	01 no
3.	Steam jacket kettle (minimum 5 litre capacity), double jacketed with indenting lever, steam inlet and outlet with steel trolley and accessories to be fitted with boiler.	02 no
4.	Deep freezer: High performance freezers with lock, digital display and contact for remote monitoring. Flexible grid dividers can be configured to suit your individual requirement. Features: Digital display, visual alarm, low energy consumption, contact for remote alarm, pull-out defrost drain for easy defrosting, lock, castors and baskets. Technical specifications: Gross Capacity: 130 Litres. Net Capacity: 130 Litres. Temperature Range: -10 ⁰ C to -45 ⁰ C. Ambient Temperature: 30 ⁰ C.	01 no
5.	Vacuum pan ((minimum 5 litre capacity), evaporation/Driven by motor reduction gear box/inside vessel made up of thick stainless steel plate/outer jacket is of S.S./with mail hole and sight glasses on 2 sides/Stirrer are made of Teflon blades. Fitted with an outlet at the bottom and a condensate receiving vessels.	01 no
6.	Mechanical peeler/ Batch type for fruit and vegetable peeling.	01 no
7.	Water purifier (50litre/hrs capacity) with pre filter, activates charcoal / resin unit and UV exposure units. Complete with water supply tank and piping.	02 no
8.	Fruit mill capacity upto (5-10 kg/hr)	01 no
9.	Pulper: <ul style="list-style-type: none"> • Capable of extracting the pulp of fruits and vegetables such as Mangoes, Guavas, Peaches, Tomatoes, Bananas etc. • Mounted on heavy duty mild steel stand, the central pulping unit of the machine consists of a pair of brushes fixed on stainless steel shaft and one stainless steel sieve. The gap between the sieve and the brushes should be adjustable • The sie beve should provided in perforations of different sizes and is easily removable for quick interchanging and cleaning. All contact parts should be of S. S. -304 Grade stainless steel. Capacity: Upto 10-20 Kg/Hour, Fitted with ½ H. P. Motor.	01 no
10.	Fruit crusher: This machine should be suitable for crushing stoneless fruits and vegetables. Mounted on a heavy duty mild steel stand equipped with motor and starter. The material should be fed into the stainless steel hopper which feeds the product into the crushing drum, which must consist of stationery blades and rotary beater which crushes the loaded	01

	product. Capacity: Upto 10-20 Kg/Hour, Fitted with ½ H. P. Motor.	
11.	Hot air oven (0-250 C) digital Display, with auto temperature controller, suitable insulated, fans, Heating elements.	01 no
12.	Refrigerator: Capacity: 310 Liter, dimensions Approx. 580x 1680x 650 mm, door cooling system, humidity controller, deodorizer, door finish vinyl, vegetable tray. Sixth sense cooling system	01 no
13.	Auto claves 20 lit cap	02 no
14.	Cabinet dryer (electrical):5 to 10 tray capacity drier, trays of SS/Aluminium, flat or perforated,3/4 W, with three phase electrical connection, temp control 0 to 150 c, auto on/off.	01 no
15.	Juice Extractor (Screw type) 1 HP motor	01 no
16.	Lime Juice Extractor & orange juice halving & Burring	01 no
17.	Crown corking machine hand/paddle operated one.	02 no
18.	pH Meter (Digital)	04 no
19.	Tray Drier: Double walled construction on heave angle, inner chamber should be made of mild steel painted with temperature resistant paint and outer finished with hammer tone paint, insulation should be done by glass wool. Temperature range 50 °C to 250°C controlled by Electronic Digital Temperature Indicator Cum Controller with an accuracy of ±5 °C, air circulation is provided by heavy duty blower with ON/OFF switch indicator. Ventilators should be provided at the top of oven. Supplied with other accessories including trays (20 trays). Workable on single phase 220/230 volts AC supply. Size (1500 x 900x900)mm (WxHxD), Capacity of tray is 24	01 no
20.	Sulphuring chamber 5 kg Capacity made up of Stainless steel, place for burning sulphur and exhaust.	01 no
21.	Vacuum Bottle filling machine capacity 5kg/hrs, made up of stainless steel.	01 no
22.	Bottle washer: with ½ HP motor, single phase, two heads for brushes, water spray unit of 10-12 bottles.	01 no
23.	Sealer for sealing of jars.	01 no
24.	Shredder for slicing of fruit and vegetable capacity 5kg/hrs.	01 no
25.	Sugar coating pan of stainless steel, revolving type with speed controller.	01 no
26.	Improved stove made up of MS with proper safety measures , with gas cylinders	01 no
27.	Pickle mixer, Rotatory type and contact part of stainless steel.	01 no
28.	Heat Sealing Machine Hand/Pedal Operated	01 no
29.	Microscope	01 no
30.	Microwave oven	01 no
31.	Liquid filling machine: For filling liquid in bottles, 200ml, 500ml, 1000ml. Manually operated	01 no
32.	Lidding machine for lidding of can/bottles	01 no
33.	Electric Mixer	02 no
34.	Vernier Calliper: 15cm 0.01 mm LC	01 no
35.	Lemon Squeezer Stainless steel	01 no
36.	Weighing balance (digital)5kg (Max),100kg (Max)	01 each
37.	Digital Weighing Balance: Capacity: 220 gm Readability: 0.1 mg or 0.0001 gm	01

	Weighing Pan: 80 mm or large, with wind draft shield. Auto Calibration should be provided with respect to temperature.	
38.	Micrometer Seam Checking guage' 0.001 LC	01 no
39.	Refractometers (Pocket) 0-32,28-62,58-920 Brix Sugar Scale	01 each
40.	Abbe Refractometer: <ul style="list-style-type: none"> • Refractive index range 1.3 to 1.7 with an accuracy of 0.001 direct on scale and 0.0001 by estimation. • Sugar percentage range 0 to 95% with an accuracy of 1% on scale and 0.1 by estimation. • Must provide test piece, contact liquid and thermometer in wooden cabinet. Should include Silica Crucible (5 Pc)	01
41.	Thermometer (Digital)	06 no
42.	Vacuum Gauge	01 no
43.	Pressure Gauge	01 no
44.	Seam Checking gauge or screw gauge	01 no
45.	Brinometer (Salinometer)	02 no
46.	Hydrometers of different ranges 0-30, 30-60, 60-90, Brixhydrometer	01 each
47.	Fruit Trays	6+2 no
48.	Stainless steel mugs	08 no
49.	Stainless steel bowls	08 no
50.	Pressure Cooker	02 no
51.	Sandashi (Tongs)	01 no
52.	Perforated spoons S.S.12"Length 4 " dia	06 no
53.	Coring knife	06 no
54.	Pitting knife	06 no
55.	Cutting knife	06 no
56.	Pilfer proof capping machine	01 no
	LUG cap sealing machine: Semi automatic sealer with easy foot switch and liver operation should works on compressed air, having air filter without compressor. Hand operated.	
57.	Can and cork Remover	As per requirement
58.	Stainless steel trays of assorted size	16 no
59.	Stainless steel buckets or stainless buckets	06 no
60.	Spoons, Wooden Ladle	16 no
61.	Masons Jars for 1 gross bottle	01 no
62.	Water Tank with tap 4'x4'z3'	01 no
63.	S.S. Vessels with lids 20 lit cap.	10 no
64.	S.S. Vessels with lids 6 lit cap.	06 no
65.	S.S.Vessels with lids 10 lit cap.	06 no
66.	Hand Washing basin with tripod stands	03 no
67.	Bottle Stand for 1 gross bottle	01 no
68.	Stainless Steel Pricker	06 no
69.	Steel scale 12" Standard steel	04 no
70.	Volume Measuring Stick	04 no
71.	Stainless Steel Strainer/Sieve	06 no
72.	Electronic Geysers 25 litre	01 no
73.	Weighing balance manual upto 10 kg	01 no
74.	Stainless steel knife	6pcs+16pcs

75.	Spoons of assorted size	16pcs
76.	Stainless steel degdhes	6pcs
77.	Jell meters	6 no
78.	Exhaust fan for lab	As per requirement
79.	Fire Extinguisher CO2, 25kg for Lab and near Boiler	As per requirement
80.	Food Processor with vegetable cutting attachment	01 no
81.	Filter press	01 no
82.	Vegetable cutter	01 no
83.	Pressure pump for the washing of machines with 2 nozzle	01 no
84.	Carbonation machines with CO2 cylinder	01 no
85.	Continuous water supply for lab	
86.	Computer/laptop for Faculty with Internet Connection with, colour Printer and photo copy Scanner	01 no
87.	LED multimedia Projector	01 no
88.	UPS 650 VA	02 no
89.	AC 5 star rating	As per requirement
90.	Labelling machine	01 no
91.	Centrifugal machine	01 no
92.	Incubator with thermostat	01 no
93.	Water Bath	01 no
94.	Bursting strength machine,	01 no
95.	Tensile strength machine,	01 no
96.	Tearing strength machine	01 no
97.	Drop tester machine.	01 no
98.	Penetrometer: Penetrometer apparatus with automatic timer and electrical arrangement with brass cone.	01 no

Consumables Tools & Items		
Sl. No	Name of Item	Quantity
1.	Beaker 50, 100, 250 ml, 500 ml	12 no
2.	Conical flask 50, 100, 250 ml, 500 ml	12 no
3.	Measuring cylinder 100ml,250ml, 200 ml, 500ml,	12 no
4.	Measuring flask of assorted sizes	12 no
5.	Burrete of assorted sizes with Burrete stands	12 no
6.	Pipettes of assorted sizes	12 no
7.	Thermometer (10°C to 110°C) Digital	16Pcs
8.	Rubber Gloves	12 pair for each trainee
9.	Aprons	01 for each trainee
10.	Jelly Filter bags	04Pcs
11.	Glass Funnels of assorted sizes	12 no
12.	Funnels 500ml. & 100ml. Separating	12 no
13.	Test Tube With Test tube stand	25 no
14.	Glass rod	10 no
15.	Gas lighter	06 no
16.	Ph meter Rod	02 no

17.	Petri dish with cover	16 no
18.	Glass slides	16pcs
19.	Refilling of gas cylinder for lab	As per required
20.	Air tight glass container of different size	As per required
21.	Different types of Empty Tin Can for canning	As per required
22.	Decaling agent for boiler coil	As per required
23.	Fuel (Light oil) for boiler	As per required
24.	Refilling of carbonation machine cylinder	As per required
25.	Label for Labelling machine	As per required
26.	Empty Glass Bottles 200ml,500ml,1000ml	As per required

Consumables items & chemicals		
Sl. No	Name of Item	Quantity
1.	Photo Copy Paper A4	As per required
2.	Scale	As per required
3.	Correcting Fluid pen	As per required
4.	Dusting Cloth	As per required
5.	Pen	As per required
6.	Temporary marker	As per required
7.	Stapler (Small & Big)	As per required
8.	Puncher	As per required
9.	Fevi stick	As per required
10.	Stapler Pin	As per required
11.	Ruled Register	As per required
12.	File Folder	As per required
13.	Vim Liquid	As per required
14.	Dettol Hand wash	As per required
15.	Scotch Bright	As per required
16.	Colin	As per required
17.	Aluminium Foils	As per required
18.	Duster	As per required
19.	Juna	As per required
20.	Seasonal Fruits and Vegetables	As per required
21.	Salt	As per required
22.	Sugar	As per required
23.	red chilly	As per required
24.	black pepper	As per required
25.	Dalchini	As per required
26.	large elaychi	As per required
27.	Jeera	As per required
28.	Saunf	As per required
29.	Laung	As per required
30.	Vinegar	As per required
31.	Hing	As per required
32.	Methi	As per required
33.	mustard oil	As per required
34.	food grade color	As per required
35.	food grade flavour	As per required
36.	Sodium Benzoate	As per required
37.	Potassium met bisulphide	As per required
38.	citric acid	As per required

39.	Glacial Acetic acid	As per required
40.	Other Chemicals/Raw material Require for Practical's	As per required
41.	Tissue paper roll	As per required

Furniture		
Sl. No	Name of Item	Quantity
Sl. No.	Class Room	Qty. for 20 trainees
1	Instructor Chair & Table with Glass	01 no
2	Magnetic White Board	01 no
3	Display Board	01 no
4	Table for computer/printer/scanner with chair	01 Set
5	Dual Desk	10 no
Sl. No.	Workshop/Lab	Qty. for 20 trainees
1	Working table with 6-3x21/2 Aluminium tops	05 no
2	Stools	20 no
3	Laboratory Table with rack (8*2'-6"-6") and sinks	04 no
4	Racks for keeping books (glass panel)etc	01 sets
5	Trainee Locker with space for 20	01 no
6	Storage Rack for Chemicals	01 no
7	Cup Board (large)	04 no
8	First Aid Box	01 no
9	Fire Extinguisher	As per required
10	Goodrej Almirha	02 no
11	Wooden Show Case For keeping & Display sample	02 no
12	White Board	01 no

- Raw material, Testing chemicals & equipments and consumables are not included in the list.
- All machines with Annual AMC.
- Proper facility for removal of waste water used for cleaning of machines from lab.
- Proper pest control facility in lab.