World Skill Development Institute

Wine Production Technology

Course Duration – 6 months.

Wine is the most loved beverage across the world and a popular accompaniment with food. The popularity of wine in India has started growing rapidly. Wine is the fermented product of the grape. Because crushed grapes contain all that is needed to create wine, ancient wine producers simply allowed nature to take its course. As time went on, people realized that by intervening at certain times, they could make a wine with more predictable characteristics. Grape cultivation is one of the most remunerative farming enterprises in India. Grapes can be eaten raw or they can be used for making wine, jam, juice, jelly, vinegar. Delicate wine grapes are generally produced in frost free and moderate temperature environments. Thousands of grape varieties are grown all over the world; the wine grape varieties represent only a fraction of them. The colour, size, phenolic distribution and acidity of grapes give each wine its own characteristic. Wine quality is affected by the factors such as soil, climate, viticulture and wine making techniques. Wine quality is dictated mainly by the grapevines, not by the winemaker. Wine must be slightly aged to be drinkable. Grape production, linked with wine processing has provided the much-needed impetus for the growth of the wine industry. Indian government plays a crucial role in the current phase of Indian wine industry, supporting the current momentum amongst others through financial assistance and market protection. Gradual reduction of import duty levels will no doubt lead to increasing competition through imports, but will on the longer term result in a competitive industry that is able to export its top quality products to overseas markets.

Some of the fundamentals of this course are wine quality, mold and mold complexes associated with grapes, grape aroma components, soluble solids in winemaking, the molds and yeasts of grapes and wine molds, yeasts of grapes and wine, by-products of fermentation, chemistry of fermentation and composition of wines, outline of red wine making, stuck wines, white table wine, sparkling wine, vermouth and flavoured wines, cider and apple wine, plum wines in Europe, berry wines in pacific coast states, cherry and plum wines in pacific coast states, pomegranate wine from concord grapes, pineapple wine, pear wine, wine from oranges, grapefruit wine, wine from dried fruits, Swiss research on fruit juice fermentation honey wine (mead), etc.

This course provides a complete detail on all aspects of Wine production like describing the varieties of wine available, its manufacturing process, bottling and storage of wine, quality control in wine making and many more. It is hoped that this course will be very resourceful to all its readers, students, scientists, technocrats, existing industries, new entrepreneurs and all those who are related to wine making.

1.THE COMPOSITION OF GRAPES

How Grapes Ripen

Physical Changes

Chemical Changes

Measurement of Maturity

Importance

How to Sample

Preparation of Sample

Methods of Measurement

Interpretation of Results

Harvesting and Transportation

Composition of Musts

Water

Sugars and Related Compounds

Acids

pH and Buffer Coefficient

Nitrogenous Components

Pigments

Tannin

Vitamins

Enzymes

Odorous Constituents

Metals

Environmental Factors

Temperature

Soil

Rainfall

Other Factors

Variety

White Table Wines

Red Table Wines

Pink or Rosé Wines

Dessert Wines

2.GRAPE MATURITY AND QUALITY

Wine Quality

Clones

Climate

Terroir

Vineyard Yield

Maturity Sampling

Maturity Gauges

Sugar per Berry

Sample Processing

Fruit Quality Evaluation

Mold and Mold Complexes Associated with Grapes

Factors Influencing Botrytis Growth

Sensory Considerations

Quantification of Botrytis

Processing Considerations for Botrytis

Pesticides

Sensory Considerations as an Indicator of Grape Maturity and Quality

Grape Aroma Components

Soluble Solids in Winemaking

Conversion of Sugar-to-Alcohol

Amelioration and Chaptalization

Monitoring Fermentation

Laboratory Measurements of Soluble Solids

Densimetric Procedures

Analysis

3.FRUIT QUALITY AND SOLUBLE SOLIDS

Maturity Sampling

Contribution of Juice Aroma

Color and Phenols

Grower Input

Sugar per Berry

Sample Processing

Fruit Evaluation

Application of Soluble Solids Data in Winemaking

Laboratory Measurements of Soluble Solids

Densimetric Procedures

4.THE MOLDS AND YEASTS OF GRAPES AND WINE

Molds

Factors Influencing Fermentation

Carbon Sources

Alcohol

Carbon Dioxide

Acids

Nitrogen

Minerals

Antiseptics

Substitutes for Sulfur Dioxide

Antibiotics

Growth Factors

Tannins

Temperature

Pressure

Oxygen

Surface Effect

Fermentation Rate

Ethyl Alcohol

Methyl Alcohol

Higher Alcohols

Glycerol

2,3-Butylene Glycol, Acetoin, and Diacetyl

Acetaldehyde

Acetal

Hydroxymethylfurfural

Esters

Volatile Acidity

Fixed Acids

Sugar

Pentoses

Pectins

Nitrogen

Tannins

Color

Oxygen

Minerals

Anions

7.RED TABLE WINE

Outline of Red Wine Making

Varieties

Testing The Grapes

Picking

Transportation

Crushing

Must Treatment

Amelioration

Addition of Sulfur Dioxide

Warming

Addition of Starter

Fermentation

Balling and Temperature Records

Punching and Pumping Over

Stuck Wines

Drawing Off

Pressing

The After-Fermentation

First Racking, Filling up, etc.

Other Methods of Red Wine Fermentation

Care of Wine

Laboratory Examination

Fining and Racking

Aging

Other Cellar Operations

Blending

Rosé

Balance of Products

8.WHITE TABLE WINE

Process

Varieties

Picking and Transporting

Processing

Crushing

Juice Separation

Settling

Amelioration

Addition of Starter

Fermentation

Aging and Finishing

Sweet Table Wines

Stabilization

9.SHERRY

California Sherry

Grapes

Picking and Delivery

Crushing

Fermentation

Settling and Racking Before Fortification

Fortification

Settling

Treatment Before Baking

Baking

Cooling and Stabilization

Clarification

Aging

Colour Removal

Blending

Addition of Sulfur Dioxide or Tannin

Excess Metals

Unbaked Sherry

Finishing

Bottling

Australia and South Africa

Spanish Sherry

Harvesting

Crushing

Plastering

Draining and Pressing

Addition of Sulfur Dioxide

Fermentation

The Solera System

The Flor Film

Blending and Finishing

Stabilizing

Spoilage

Classes of Spanish Sherries

The Yeasts

Sulfur Dioxide Tolerance

Effect of Film on Acids

Effect of Sugars and Yeast Nutrients

Effect of Yeast Lees on Flavor

Winery Experiments

Submerged Flor Process

Carbonation

12.VERMOUTH AND FLAVOURED WINES

Origin

Herbs and Spices

Methods of Flavoring Base Wine

Italian-Type (Sweet) Vermouth

Italian Methods

Aging and Finishing

California Methods

French-Type (Dry) Vermouth

European Methods

California Methods

Composition of Vermouth

Non-vermouth Types

Special Natural Wines

13.FRUIT WINES

Cider and Apple Wine

Statistics

Apples for Cider in Europe

Composition of Cider Apples

French Methods

Swiss Methods

German Methods

English Methods

Californian Methods

Dissolved Gases in Wines

Acidity Effects of Dissolved CO2

Chemical Additives

Bottling Operations

Quality Control

The Bottling Room

Dedusting and Rinsing of Bottles

Filling Machines

Corks and Cork-insertion Machines

Labeling Machines

Capsulators and Foiling Machines

Gas Exchange During Bottling Operations

Pressure in Filled Bottles

Other Operations

Transport and Storage Considerations

Storage Temperature and Temperature Variations

The Cooling and Warming of Bottled Wine

15.MICROBIOLOGICAL SPOILAGE OF WINE AND ITS CONTROL

Definitions of Microbiological Spoilage

Origins of Wine Spoilage Microorganisms

Diagnosis of Spoilage as Microbiological

Kinds of Microbiological Spoilages of Wine

Identification of Wine Spoilage Microorganisms

Importance of Identification

Cultivation, Isolation, and Purification of Wine Microbes

Spoilage by Molds and Yeasts

Spoilage by Molds

Corkiness

Spoilage by Wild Yeasts

Spoilage by Wine Yeasts

Spoilage by Zygosaccharomyces Yeast

Spoilage by Brettanomyces Yeast

Spoilage by Lactic Acid Bacteria

Misplaced Malolactic Fermentations

Malolactic Fermentation by Undesirable Bacteria

Ropy Wines

Ferocious Lactobacillus Fermentations

Spoilage of Fortified Wines by Lactobacillus

Mousey Wines

Other Spoilages by Lactic Acid Bacteria

Spoilage by Acetic Acid Bacteria

Kinds of Wine-Related Acetic Acid Bacteria

Prevention and Control of Acetic Acid Bacterial Spoilage

Taxonomy of the Wine-Acetic Acid Bacteria

Spoilage by Other Aerobic Bacteria

Spoilage by Bacillus

Spoilage by Zymomonas

16.CARBOHYDRATES : REDUCING SUGARS

Reducing Sugars (Hexoses)

Sucrose

Pentoses

Polysaccharides

Analysis of Reducing Sugars

Rapid Determination of Reducing Sugars

Brix Vs. Reducing Sugar Values

17.YEAST AND BIOCHEMISTRY OF ETHANOL FERMENTATION

Definition, Origins, and Identification of Wine-Related Yeasts

Definition of Wine-Related Yeasts

Origins of Wine-Related Yeast

Identification of Wine-Related Yeasts

Natural Grape and Winery Flora

Fermentation Inoculation Practices

Starter Cultures

Natural Fermentations

Dominance by Saccharomyces

Yeast Morphology and Cellular Organization

Yeast Nutrition and Growth Characteristics

Carbon Metabolism

Noncarbon Nutrition

Fermentation Biochemistry

Glycolysis

Fermentation Kinetics

The Rate of Cell Growth

Cell Growth and Substrate Preference

Sugar Consumption by Cell Maintenance

Rate of Sugar Consumption

Rates of Cell Death

Rate of Formation of Ethanol

Rate of Change in Density

Temperature Effects

Rates of Heat Release

End Products of Yeast Metabolism

Glycerol, Volatile, and Nonvolatile Organic Acids

Higher (Fusel) Alcohols

Nitrogen Metabolism during Fermentation

Uptake and Transport

Utilization Preferences

Intracellular Pools

Utilization Pathways

Important End Products of Nitrogen Metabolism

Nitrogen Metabolism and Effect on Glycolytic Flux

Sulfur Metabolism during Fermentation

Problem Fermentations

Stuck or Sluggish Fermentations

Production of Off-Characters

Ethanol Tolerance

Fermentation Bouquet and Other Volatile Esters

18.PHENOLIC COMPOUNDS AND WINE COLOR

Representative Grape and Wine Phenols

Nonflavonoid Phenols

Flavonoid Phenols

Complex Phenols (Tannins)

Sensory Considerations

Anthocyanins/Anthocyanidins

Grape Growing and Processing Considerations

Grape Phenols

Grape Maturity and Wine Phenols

White Wine Processing Considerations

Red Wine Processing Considerations

Factors Contributing to Wine Color and Color Stability

Alternative Techniques for Color Extraction

Oxidation

Enzymatic Oxidation of Musts

Oxidation of Wines

Secondary Browning Reactions

Phenol Instability

Oak Barrel Components

Processing Considerations

Evaluation of Color by Spectrophotometry

Tristimulus Color

Spectral Estimations of Red Juice and Wine Phenols

Spectral Estimation of White Juice and Wine Phenols

Analysis

19.OXYGEN, CARBON DIOXIDE AND ASCORBIC ACID

Oxygen

Importance of Oxygen in Yeast Metabolism

Redox Potentials of Wine Systems

Acetaldehyde

Carbon Dioxide

Ascorbic Acid

Modes of Action of Ascorbic Acid

20.EVALUATION OF WINES AND BRANDIES

Sensory Examination

Tasting Glasses

Appearance

Odor

Taste

Flavor

Difference Tasting

Scoring Wines Numerically

Hedonic and Flavor Profile

Frequency of Tasting

Microscopical Examination

Musts

Examination of Yeast Starters

Wines

Chemical Analysis of Wines

Hydrometers

Acidity

Volatile Acidity

Fixed Acidity and pH

Alcohol

Extract of Dealcoholized Sample

Reducing Sugars

Balling-Alcohol-Extract Chart

Determination of Sulfur Dioxide

Tannin and Coloring Matter

Color

Aldehydes

Iron Determination

Copper Determination

Ester Determination

Hydroxymethylfurfural

Carbon Dioxide

Modified Hubach Test

Other Determinations

Brandy

Apparent Proof

True Proof

Extract

Acidity

Fusel Oil

Aldehydes

Furfural