SYLLABUS
PG DIPLOMA IN QUALITY CONTROL & ENVIRONMENTAL SCIENCE

SUBJECT: SUGAR TECHNOLOGY (THEORY)
CODE: DQ/101 **MAX.MARKS: 100**

1. Composition of sugar cane.
2. Composition of sugar cane juice. Introduction to terminology used in Sugar Industry. Kinds of sugar, Raw, plantation white & refined sugar.
3. Process flow diagram of Double Sulphitation process and refined sugar process.
4. Clarificants used in processing.
5. Brief details of various unit operations such as Milling, Clarification, heating, Evaporation, Pan Boiling (Crystallization), Centrifugation and bagging
6. Role of reducing sugars, phosphate and calcium content during the processing of sugar cane juice
7. BIS standards for plantation white and other sugars, FSSAI standards, Sugar grade as issued by Bureau of Sugar Standard.
8. General idea about sugar handling and storage.
9. Methods of sugar cane juice clarification, defecation, double Sulphitation, phosphoflotation and Carbonation (for refined sugar), ion exchange resin & powder activated carobn.
10. Process parameters and their role in clarification process.
11. Sampling techniques, Control parameters, idea about efficiency parameters.
12. Role of sanitization in sugar manufacturing process.
13. Merits & Demerits of Hot & Cold imbibition .

SUBJECT: SUGAR TECHNOLOGY (CHEMICAL CONTROL)
CODE: DQ/102 **MAX.MARKS:100**

(i) Determination of Pol % cane
(ii) Mill Extraction (M.E.)
(iii) Reduced Mill Extraction (R.M.E.)
(iv) SJM Formula
(v) Reduced Boiling House Recovery (R.B.H.R.)
(vi) Brix Curve
(vii) Pol Balance
(viii) Brix Balance
(ix) Non Sugar Balance
(x) Calculation of Recovery etc.
(xi) Actual vs. theoretical molasses % cane
(xii) Stock taking calculations
(xiii) Preparation of Technical laboratory reports- RT8(C), RT7(C) , Daily Manufacturing Report etc.
(xiv) Primary Extraction

SUBJECT: ENVIRONMENTAL SCIENCE (THEORY)
CODE: DQ/103 **MAX.MARKS:100**

1- Definition, Scope and basic principles of ecology and environment. Biological levels of organization, population, community, ecosystem and biosphere. Ablotic factor, Habitat, Keystone spacies, Dominent species, Ecotone, Edge Effect, Coral reef, Mangroves.

2- **Components of Environment** – Hydrosphere, lithosphere, atmosphere and biosphere – definitions with examples; Interaction of man and environment; Environmental Studies as a multidisciplinary subject.

3- **Global Environmental Problems** – Green House Effect, Acid rain, El Nino, Ozone depletion, deforestation, desertification, salination, biodiversity loss; chemical and radiation hazards. Positive and negative interactions of populations – competition, predation, parasitism, mutualism , Soil erosion, Land degradation, Wasterland.

4 -Ecosystem : Basic concepts, components of ecosystem. Trophic levels, food chains and food webs. Ecological pyramids, ecosystem functions. Carbon, Nitrogen, Phosphorus and Sulphur Cycles. Chemical Composition of air, water Chemistry and lithosphere (Chemical composition of earth minerals, fossil Fuels and Soil). Major & Minor, Biogeographic & Agro climatic Zones of India.

4- **Environmental pollution and degradation** – Pollution of air, water and land with reference to their causes, nature of pollutions, impact and control strategies. Noise pollution. Environmental damage by agriculture, perspectives of pollution in urban, industrial and rural areas, acts and guidance's for pollution control specific to sugar and distillation units.

5- **Environmental Management** – Concept of health and sanitation. Environmental diseases – infectious (water and air borne) and pollution related, spread and control of these diseases, health hazards due to pesticide and metal pollution, waste treatment, solid waste management, environmental standards and quality monitoring. Bioremediation – Oil spills, Wastewater treatments, chemical degradation, heavy Metals, utilization of water natural resources for industrial application.

SUBJECT: ALCOHOL TECHNOLOGY (THEORY)

CODE: DQ/104 **MAX.MARKS: 100**

1. **Biochemistry –**
   CARBOHYDRATES: General idea about structure and properties of monosaccharide, disaccharides. oligosaccharides and polysaccharides.
2. **Microbiology**
   The microscope, Microbial Diversity: Prokaryotes and Eukaryotes, Microalgae, Microfungi, Protozoa, Bacteria and Viruses, Bacterial size, shapes and pattern of arrangement, Structures external to cell wall: Flagella, Pili, Capsule, sheath, Pros thecae and stalk.
   The cell wall structure: Gram positive and gram negative bacteria. Reproduction and growth of bacteria & Yeast. Modes of cell division, Growth curve, Lag phase, Exponential phase, stationary phase and death phase, Nutritional requirements. Nutritional types of bacteria, Phototrophs, Chemotrophs, Autotrophs, Heterotrophs, Obligate parasites. Bacteriological media, Selective media, Maintenance media, Differential media. Control of microorganisms, Definitions and fundamentals of control, Physical agents / processes for control: high temperatures, low temperature, desiccation, osmotic pressure, radiation, filtration.
3. **Alcohol Technology & Bio-Products.**

   General idea about molasses, its grades and other feed stocks for ethanol production, idea about unit operations in molasses and grain based distilleries. Fermentation, types of fermentations and role of microorganism and other condition on fermentation. Techniquesof distillation, absorption

& multi pressure. Production of grain spirit. Chemical control, Theoretical Yield, Fermentation & Distillation Efficiency etc.

Brewing technology: Malting, mashing, fermentation and pasteurization of beer, defects of beer. Fusel oil; Spent lees, Condensates, spent wash, colored effluents and Concentrates

4. Physical Chemistry:

(i) Introduction to Modern Quality Control System:

- Introduction to concept and importance of quality
- ISO- 9001:2000, Quality Management System – principles and its advantages
- Environment Management System – ISO-14000, ISO-14001
- ISO-22000:2005, HACCP, WHO, WTO, CODEX, GMP,GLP,
- BIS, FSSAI and CODEX standards

(ii) Colour: Colourimetry, Lambert Beer's Law, Determination of λ_{max} , Measurement of colour of Sugar in solution Phase by GS9/1/2/2-8 (MOPS Method), GS9/1/2/2-9 (TEA Method) and GS9/1/2/2-10 (ISO Grade water Method),

(iii) Conductivity: Specific Conductance, Molar Conductance and Equivalent Conductance and factors affecting them, Measurement of Conductivity ash.

(iv) Turbidity: Concept of Turbidity, reason for appearance turbidity, Method of determination of turbidity by Turbidity-meter.

(v) Analytical Chemistry: Concept of Mole, Normality, Molarity, Molality, Formality, ppm, ppb, ppt, Mole Fraction and Equivalent weight

SUBJECT: WATER MANAGMENT & EFFLUENT TREATMENT (THEORY)

CODE : DQ/105 **MAX.MARKS: 100**

Effluent treatment in Sugar Factories:

1. Fresh water requirement in sugar processing. Source of fresh water with-drawl.
2. Generation of condensates from various heat exchangers, their quantity and utilization.
3. Hot and cold water utilization in sugar processing, water conservation, recycling, condensate polishing and water balance.
4. Sources of effluent generation in sugar industry and measures to reduce it, cooling and recycling of condensates, condensate polishing units etc., norms for effluent disposal-quantity and quality as per CPCB norms.
5. Techniques of effluent treatment- activated sludge process, bio-filter and others, various stages of effluent treatment, primary, secondary and tertiary, storage of treated effluent in lagoons, general idea about the lay out of the Effluent Treatment Plants. Pre-requisites as per CPCB norms.

Effluent treatment in grain and Molasses based Distilleries:

1. Fresh water requirement in grain and molasses based distilleries, sources of fresh water with-drawl.
2. Generation of condensates from various heat exchangers, their quantity and utilization, spent leese.
3. Hot and cold water utilization in alcohol processing, water conservation, recycling, condensate polishing and water balance.
4. Different routes of spent wash treatment in Molasses based distilleries to attain ZLD as per CPCB norms, including bio-methanation, multiple effect evaporation/RO and bio-composting or multiple effect evaporation/RO and incineration. Spent wash treatment in grain based distilleries, DDGS.
5. Misc. requirements as per CPCB norms for installation of PTZ cameras, mass flow meters, lagoons, norms for bio-composting, rain water harvesting, green belt, ground water quality etc.

SUBJECT: SUGAR TECHNOLOGY (PRACTICAL)
CODE: DQ/106 **MAX.MARKS: 100**

(i) Brix / Pol / Purity of juice/molasses/massecuite and other sugar house products
(ii) Sucrose %, P_2O_5, RS & CaO Content in mixed juice and clear juice etc
(iii) Crystal % massecuite
(iv) Size & shape of crystal
(v) Moisture % sugar
(vi) Pol and Moisture % Bagasse
(vii) Pol % Press cake
(viii) Preparatory Index of cane
(ix) Determination of Total and free SO_2 content in sugar by Iodine and p-rosanaline hydrochloride.
(x) Determination of MR value of the sugar.
(xi) Colour determination of sugar and boiling house products.

SUBJECT: ALCOHOL TECHNOLOGY (PRACTICAL)
CODE: DQ/107 **MAX.MARKS:100**

1. Analysis of molasses for brix, pol, purity and total reducing sugar content.
2. Determination of starch content in grains.
3. Microscopic examination of microorganisms like bacteria, yeast, fungi etc.
4. Preparation and sterilization of culture media like nutrient agar medium, malt extract medium, molasses agar medium etc., preparation of slants and stabs.
5. Acquaintance with different microbiological techniques like inoculation, streaking, plating etc., aseptic handling of culture media and pure cultures.
6. Isolation and development of a pure yeast culture
7. Preparation of bacterial culture slides and staining by Gram stain.
8. Dilution and plating of culture for total viable cell count.
9. Differential counting of living and dead yeast cells by direct microscopic examination.
10. Analysis of alcohol for ethanol content.

SUBJECT: GENERAL CHEMISTRY (PRACTICAL)
CODE: DQ/108 **MAX.MARKS: 100**

(i) Measurement of colour of sugar in solution phase by GS9/1/2/2-8, GS9/2/2/2-9 and GS9/1/2/2-10 method.
(ii) Measurement of Conductivity ash in sugar by ICUMSA Method.
(iii) Determination of turbidity in sugar by Turbidity-meter and calibration of Turbidity meter.
(iv) Determination of pH of sugar solution by pH-meter and calibration of pH meter.
(v) Determination of specific conductivity of sugar solution by Conductivity-meter and calibration of Conductivity-meter.
(vi) Determination of conductivity-ash of sugar solution by ICUMSA method.
(vii) Preparation and standardization of solutions of different concentration.
(viii) Determination of phosphate content in juices
(ix) Determination of dextran content in juices

SUBJECT: ENVIRONMENT SCIENCE (PRACTICAL)

CODE: DQ/109 **MAX.MARKS:100**

(i) TSS in various waters/effluents
(ii) TDS in various waters/effluents.
(iii) Hardness in feed and boiler water
(iv) Silica content, Phosphate in feed water, boiler water, blow down water and various condensate.

(i) to (iv) by Agriculture Chemistry Division

(v) Determination of pH of effluents

(vi) Determination of total solids, suspended solids and dissolved solids of effluents, sulphate content.

(vii) Determination of Chemical Oxygen Demand (COD) Value of effluents by titration.

(viii) Determination of Dissolved Oxygen (DO) Value and Biochemical Oxygen Demand (BOD) value of effluent samples.

(ix) MLSS (Mixed Liquid Suspended Solids)

(x) Determination of oil & grease content in effluents.

(v) to (x) by Bio Chemistry Division