

# **NATIONAL SUGAR INSTITUTE**

MINISTRY OF CONSUMER AFFAIRS, FOOD & PUBLIC DISTRIBUTION  
DEPARTMENT OF FOOD & PUBLIC DISTRIBUTION  
Government of India  
**KANPUR**



सत्यमेव जयते

**ACADEMIC  
BULLETIN- 2018**

For

**SUGAR ENGINEERING  
CERTIFICATE COURSE**

**(S.E.C.C.)**

**SUGAR ENGINEERING CERTIFICATE COURSE**  
**S . E . C . C .**  
**ACADEMIC CALENDAR**

<b>1.</b>	<b>Admission</b>	<b>July-2018</b>
<b>2.</b>	<b>First Year Theory &amp; Practical Classes</b>	<b>July-2018 to October - 2018</b>
<b>3.</b>	<b>Events organized by Games &amp; Sports, Cultural, Scientific Society</b>	<b>August/ September-2018</b>
<b>4.</b>	<b>First Year Examination</b>	<b>1-15 November- 2018</b>
<b>5.</b>	<b>In Plant Training</b>	<b>From 20 November- 2018 to April-2019</b>
<b>6.</b>	<b>Submission of In plant Training Report &amp; viva voce</b>	<b>1-15 May- 2019</b>
<b>7.</b>	<b>Summer Vacation</b>	<b>16 May to June -2019</b>
<b>8.</b>	<b>Second Year Theory &amp; Practical Classes</b>	<b>July-2019 to October- 2019</b>
<b>9.</b>	<b>Events organized by Games &amp; Sports, Cultural, Scientific Society</b>	<b>August/ September-2019</b>
<b>10.</b>	<b>Second Year Examination</b>	<b>November -2019</b>
<b>11.</b>	<b>Campus Interview through placement cell</b>	<b>As per the demand and Convenience of the industry.</b>

- Note:**
- 1. The working of the Institute is from Monday to Friday i.e. five days in a week.**
  - 2. The Institute also observed holidays for Central Government Offices in Kanpur.**

## 1. RULES FOR ATTENDANCE AND LEAVE

- 1.1 A student is required to put in a minimum of 75 percent attendance during each session in each subject. Non-compliance of this rule will render him liable to be debarred from appearing at the Diploma Examination.
- 1.2 Ordinarily, leave for 15 days in admissible to a student is an academic year.
- 1.3 Application of leave for absence must be handed over at the Education Section on the prescribed form.
- 1.4 Application for leave must be counter signed by the Hostel Warden or the approved guardian.
- 1.5 Application for Sick leave must be accompanied by a certificate from the Medical Officer of the Hostel.
- 1.6 Absence without leave by a student drawing a scholarship may result in the cancellation or reduction of his scholarship.

2. **RAGGING** : *Ragging is strictly prohibited vide directions of Hon'ble Supreme Court in SLP No2495 of 2006 dated 16.05.2007 and in Civil Appeal No 887 of 2009, dated 08.05.2009. Any student found guilty of ragging and /or abetting ragging is liable to be punished.*

## 3. FACTORY TRAINING

Students of the S.E.C.C. Course are sent for factory training to sugar factories during the season, which enables them to supplement their theoretical knowledge with practical aspects. The Institute recommends to the factories receiving students for practical training, to give them suitable Stipend, lodging, accommodation etc., during the course for their training at the factory.

## 4. SCHEME OF EXAMINATIONS

- 4.1 The examinations are held at the appropriate time as per Institute's calendar. Class tests may also be held during the middle of the session. Marks obtained at these tests and examinations as well as the marks assigned for class work and lecture notes of each student will be recorded for his class marks in each term.
- 4.2 **Classification of Results:**  
It is necessary to pass in each subject separately in Theory and Practical .The minimum pass marks in theory 35% and 50% in Practical. The candidate would be declared to have passed a particular course in case he secures a minimum of 50% marks in aggregate.

The division to students at the end of examinations are given according to the following standards:-

First Division	. . . . .	75% and above
Second Division	. . . . .	60% and above
Third Division	. . . . .	50% and above

### 4.3 Supplementary Examination

4.3.1 If a candidate fails in maximum of any two subjects at the First/Second/Final year examination but secures 50% marks in aggregate, he will be allowed to appear in the supplementary examination for these two subjects.

4.3.2 A candidate allowed to appear in the supplementary examination would be provisionally promoted to the next higher class and in case he fails in the supplementary examination also, he would be reverted to the lower class on declaration of supplementary examination results.

4.3.3 The student who passes in the said examination of any course in supplementary examination will be declared as “PASSED” and no division will be awarded to him.

### 4.4 Re-admission of Failed Students

If a candidate fails in First/Final year examinations (including supplementary examination). He/she will be permitted to take the re-admission again in the following year, provided he/she attends the Institute as a regular student in the same class in which he/she had failed. If a student fails three times in a particular class he will be not re-admitted in that class in the Institute. If after failing in the class once a candidate does not take re-admission in the same class in the immediate next session his/her case will not be considered in future for re-admission.

4.5 **Schedule of marks:** The schedule of marks for different subjects for the examination is as follows.

## FIRST YEAR EXAMINATION

Subject	Maximum Marks
<b>THEORY</b>	
1. Sugar Technology . . . . .	50
2. Chemical Engineering. . . . .	50
3. Sugar Engineering and Instrumentation (60+40) . . . . .	100
4. Electrical Engineering & Mechanical Engineering (50+50). . . . .	100
5. Drawing & Design . . . . .	100
<b>SESSIONAL</b>	
6. Class marks	100
7. Inplant Factory Training (Factory Report) - - -	50
8. Viva Voce - - -	50
<b>GRAND TOTAL</b> .	<b>600</b>

## SECOND YEAR EXAMINATION

Subject	Maximum Marks
<b>THEORY</b>	
1 Sugar Technology . . . . .	50
2 Chemical Technology & Engineering. . . . .	50
3 Sugar Engineering . . . . .	100
4 Electrical Engineering . . . . .	50
5 Mechanical Engineering . . . . .	50
6 Instrumentation . . . . .	50
7 Drawing & Design . . . . .	100
<b>PRACTICAL</b>	
8 Sugar Technology - . . . . .	50
<b>SESSIONAL</b>	
9 Class Marks	100
10 1/3 <sup>rd</sup> Marks of First Year Examination -	200
<b>GRAND TOTAL .</b>	<b>800</b>

# **SYLLABUS**

## **SUGAR ENGINEERING CERTIFICATE COURSE**

### **FIRST YEAR**

#### **(S.E.C.C.)**

**SUBJECT : SUGAR TECHNOLOGY(THEORY)**  
**CODE : EC/101** **MAX. MARKS : 50**

1. Brief idea about manufacture of Raw, Plantation white Sugar and refined Sugar.: Juice extraction from sugarcane; Maceration and imbibition; Different maceration schemes; Use of cold and hot water for maceration; Importance of mill sanitation.
2. Measurement and weighment of Juice water measuring tanks, heaters, single and double beet valves, use of vapour and steam in heaters.
3. Juice heaters- Operation of tubular and plate type juice heaters, Single and double beet valves, Use of Vapour and steam in heaters.
4. Specifications of lime and sulphur used for clarification of juice. Air used for SO<sub>2</sub> production, Lime Kilns. Operation of lime slaker, lime classifier, batch and continuous sulphur furnaces, Importance of gas cooler and gas scrubbers.
5. Composition of cane and cane juice; different processes of cane juice clarification-defecation, double sulphitation (continuous liming and sulphitation), Phosphotlation and carronation process of melt clarification comparison of different clarification methods.
6. Preliminary idea about settling-settling rats and factors affecting it, Stoke's Law, batch settling, continuous settling its advantages over batch settling; types of continuous clarifiers (Graver, Rapi Dorr,444 etc.) and their details of working. Importance of settling aids and disinfectants in clarifiers.
7. Types of filters-Plate & Frame type filter presses, their construction and operation. Rotary Vacuum filter, its construction and details of its operation, pressure filtration, leaf filters, Deep head filters and Decanters.
8. Capacity of machinery & equipments  
Selection of site, cane feeding, cane carrier, cane knives; power required for cane carrier, cane knives & mills; crushing capacity of milling tandems and power required; boilers, maceration pumps, mixed juice pumps, mixed juice tanks, mixed juice weighment scale, lime kiln, ,lime slaker, lime storage tanks, milk of lime pumps, sulphur furnaces, air compressors, juice heaters, juice sulphiter, continuous clarifiers, vacuum filters, plate & frame filter presses for carbonation and sulphitation factoriers. Evaporators, condensers, injection and spray pumps, condensate extraction pumps, syrup sulphiter, syrup pump, syrup and molasses tanks, supply tanks, vacuum pans, crystallizers, batch and continuous centrifugals machines.

9. Chemical Control:

Milling control- Technical definitions, calculation of brix percent bagasse, fibre percent bagasse, fibre percent cane, undiluted juice lost in bagasse percent fibre, added water percent fibre, added water extracted in mixed juice percent added water, primary and secondary mill extraction, ideal extraction, mill extraction, brix curves, brix free cane water. Dirt and foam correction, reduced mill extraction, E.R.Q.V. ratios, mill sanitation, comparison of milling efficiencies of factories. Capacity utilization.

Boiling House Control:

Brix balance, pol balance and non-sugar balance, Clarification efficiency, E.S.G. value of commercial sugar, Boiling House recovery, Basic Boiling House Recovery, Boiling House performance and Boiling House Recovery (ESG), Reduced Boiling House Recovery. Noel Deer and Gundu Rao Reduced overall extraction.

**Reference Books:** 1- Principles of Sugar Technology, Vol 1-3 by Peter Honig, Elsaevier Poh, Co., Newyork.  
2- Training manual for sugar mills by Mangal Singh, Somaiya Pvt. Ltd. Mumbai.

**SUBJECT : CHEMICAL ENGINEERING**

**CODE : EC/102**

**MAX. MARKS : 50**

**1. Introduction to chemical engineering.**

1. Concept of unit operation and unit processes
2. Mass and energy balance computation and application to steam generation process.

**2. Process fluid mechanics.**

1. Bernoullis theorem and its applications to compressible and incompressible process fluids.
2. Process pumps- Classification, selection and sizing.
3. Process piping and pipe components. Pipeline sizing for steam and condensates; Juices, molasses and Masecuits as per standards and codes(ASME 31.3) – Modes of failure of piping systems.

**3. Process heat transfer.**

1. Conductive Convective and radiant heat transfer. Boiling and condensation. Effect of parameters in sugar process and operating conditions .
2. Selections and sizing of heat exchange equipments- heaters, condensers and condensate heat recovery systems.

**Reference Book**

1. Geanhoplis
2. Ghosal/ Sanyal/ Dutta
3. Heat Transfer- B.K. Dutta

**SUBJECT : SUGAR ENGINEERING**  
**CODE : EC/103A** **MAX. MARKS : 60**

1. Cane handling: Different systems and equipments used with details in brief.
2. Cane Carrier: Slope, length, speed, width, power consumption etc.
3. Cane Preparation: Principle, Construction, power consumption, assessment of cane preparation (bulk density, preparatory index) by knives, Fibrizer, Shredder, etc.
4. Mills: Function, different types of housings, roller groovings, pressures in milling, hydraulic pressure calculations, mill feeding devices, mill drives.
5. Boilers: Types of boilers used in Sugar plants, furnaces, super heaters, Economiser, Air Pre-heater, Calculations, testing and complete heat balance calculations.

**SUBJECT : INSTRUMENTATION**  
**CODE : EC/103B** **MAX. MARKS : 40**

1. Terminology: Terms associated with Instrument Technology like accuracy, precision, calibration etc.
2. Pressure: Definition, different types of pressure like Gauge pressure, Atmospheric pressure and absolute pressure-relation between them. Units of pressure and relation between them. Measurement of pressure by manometer: Simple U tube type.
3. Vacuum: Definition, measurement of vacuum by U tube mercury manometer.
4. Elastic devices: Bourden tube, Diaphragm and Bellows: Construction and working of a 'C' type bourden tube type pressure gauges, construction and working of vacuum gauges, its error and how to remove them. Its calibration procedure. Application of Diaphragm and Bellows.
5. Measurement of temperature: Filled system thermometer, gas filled, vapour pressure filled and liquid filled thermometer. Construction and working of gas filled, vapour pressure filled and liquid filled thermometer. General discussion on its merits and demerits and range of application etc. Resistance thermometer: Elements, construction, working theory and application. Thermocouple: Different types, ranges, construction, working theory and application.  
Pyrometer: Different types, construction, working theory & application.
6. Measurement of flow: Orifice plate; Flow measurement with the help of orifice plate. Accuracy and area of application.  
Rotameter: Construction, working theory, accuracy and application.
7. Measurement of level: Sight gauge glass, float and counter weight type.
8. Transducers; Classification of transducer, criterion for selecting a transducer, use of Transducer in measurement of process variables in sugar industry.

**Reference Book:- Industrial Instrumentation and Control- S.K. Singh.**



**SUBJECT** : ELECTRICAL ENGINEERING & MECHANICAL  
ENGINEERING  
**CODE** : EC/104 **MAX. MARKS** : 100

(A) MECHANICAL ENGINEERING

1. Properties of Steam: Use of steam tables, specific volume, internal energy of steam, dryness fraction, dry, saturated & super heated steam calculations etc.
2. Combustion of Fuel: Principles, theoretical air and total air required for combustion of fuels, combustion products, Calculations.
3. Boiler: Classifications, Mountings and accessories, Draught, construction of different types of boilers, operation, performance, Calculations.

(B) ELECTRICAL ENGINEERING

1. Construction of direct current machines. EMF equations
2. D.C. Generators: Classification, Characteristics, condition of parallel operation. Efficiency, Calculations
3. D.C. Motors: Principles, classification, characteristics, speed of control D.C Motor, electromagnetic Torque, Relation between torque and back EMF, DC Motor starter, Braking of DCM application as variable speed motors.
4. Alternating Current: R.L.C. Circuits, Vector diagram & Electrical resonances etc.

**Reference Book- Fundamental of Electric Machine: BR Gupta & Vandana Singhal**

**-A Text Book of Electrical Technology: BL Theraja**

**SUBJECT** : DRAWING & DESIGN  
**CODE** : EC/105 **MAX. MARKS** : 100

1. JUICE HEATER :  
THEORY  
Objective and function of juice heaters.  
Design procedure of juice heaters for given heating surface & crushing rate, calculation of total no. of tubes, no. of tubes per pass, no. of passes, no. of compartments, dia of tube plate, thickness of tube plate & calendria shell, size of juice inlet/outlet, size of steam inlet, size of condensate outlet and vent pipes etc.

**PRACTICAL**

- i. Drawing of general arrangement,
- ii. Drawing of top and bottom headers.

2. EVAPORATOR:  
THEORY

Objective and function of evaporator.

For given heating surface calculation of total no. of tubes, dia of tube plate and down-take, thickness of tube plate, calendria shell & vapour body. Size of juice inlet and outlet, size of steam inlet, size of condensate outlet and venting pipes. Design of internal catch-all.

PRACTICAL

- i. Drawing of top and bottom tube plate showing steam gullies, tie-rods, ventings, condensate removal etc.
- ii. Drawing of catch – all
- iii. General arrangement drawing of evaporator.

3. FINAL MOLASSES STORAGE TANK:  
THEORY

To calculate the dia and height of molasses tank, selection of width of course, calculation of no. of courses, thickness of each course. Brief idea on various longitudinal and transvers welded joints used in fabrication of molasses tank shell.

PRACTICAL

Drawing of molasses tank shell.

4. THEORY

Fundamental of Computer Aided Drafting & Designs.

Practices on Computer Aided Drafting & Designs in Auto Cad Lab.

# **SYLLABUS**

## **SUGAR ENGINEERING CERTIFICATE COURSE SECOND YEAR (S.E.C.C.)**

**SUBJECT : SUGAR TECHNOLOGY(THEORY)**  
**CODE : EC/201 MAX. MARKS : 50**

1. Single and multiple effect evaporation, Vapour cell (Robert type) and semi-Kestners. Economy and capacity of evaporator; Vapour bleeding; Scales formation and their effect on efficiency of evaporators, removal of scales, removal of condensate and in-condensable gases, causes of entrainment and remedial measures for checking.
2. Syrup treatment for white sugar manufacture.
3. Different methods of graining. Merits of true seeding graining method over other methods; 2,3 and 4 Masecuits boiling schemes giving purities of syrup, Masecuits, molasses etc.; false grain and conglomerate type of vacuum pans-Coil and Calendria pans. Circulation inside pans, pan control instruments.
4. Specifications of raw sugar. A brief description of the process for its production. Storage of raw sugar.
5. Different types of air cooled, water cooled and vacuum crystallizers. Treatment of low grade Masecuits in crystallizers.
6. Rotary sugar driers, grass hopper drier elevators, sugar graders.
7. Indian Standard Specifications of plantation white sugar, Refined sugar and Raw Sugar.

### **Factory Practical:**

Study the Construction and operational technique of boiling house equipments in Experimental Sugar Factory.

**Reference Books:-** 1- Cane Sugar Manufacturer in India by D.P. Kulkarni, STAI, New Delhi  
2- Hand Book of cane Sugar Engineering by E. Hugot, Elsevier Puh. Co. Ltd. New York.

**SUBJECT : CHEMICAL TECHNOLOGY & ENGINEERING**  
**CODE : EC/202 MAX. MARKS : 50**

### **1. Introduction to leaching and extraction process.**

1. Basic principals – Equilibrium stages and stage efficiencies, single, cross current and counter current operations.
2. Application of fundamental principals to cane sugar milling and imbibitions processes and to diffusion in beat sugar manufacture.
3. Chemical Engineering analysis of equipment for milling and diffusional operations.

## **2. Process and waste water engineering.**

1. Basic principal of waste water engineering – primary secondary and tertiary treatment
2. Water treatment practice in sugar manufacture. Concept of zero discharge, treatment, recovery and reuse of waste water standards for sugar industries.
3. Process water and condensates- Selection and sizing of storage, piping and heat recovery systems.

**Reference Books:-** 1. Mass Transfer by Treybal

2.Environmental Pollution Control by C.S. Rao

**SUBJECT : SUGAR ENGINEERING**

**CODE : EC/203 MAX. MARKS : 100**

1. Mill gearings, mill speeds, mill settings, power requirements, mill capacity calculations, mill performance, etc.
2. Diffusion and Diffusers- Introduction and comparison with milling systems
3. Boiler Feed Water, quality, control and systems.
4. Steam accumulators, reducing valves and de-super heaters.
5. Pressure reducing valves and de-super heaters.
6. Prime movers: Estimation of power requirements and exhaust production in the sugar factory.
7. Process steam consumption and heat balance calculations.
8. Conservation of Heat: Heat losses and their prevention by lagging, different types of steam traps etc.
9. Different types of pumps used in the sugar factories.
10. Preventive and Predictive maintenance in the sugar factory.

**SUBJECT : ELECTRICAL ENGINEERING**

**CODE : EC/204 MAX. MARKS : 50**

1. Polyphase Circuits: Star - delta connections, Calculations etc.
2. Transformer: Principle, Classification, Transformation - ratio, Auto-transformer etc, EMF equation voltage Regulation, losses, Efficiency Transformers Tests, conditions of parallel operations instrument Transformers.
3. Induction motors, Principle, Classification, different types of starters, speed control of AC Motors, Application use with respect to sugar plants.
4. **Alternator:** Principle, Construction & Testing.
5. Power Factor- Improvement Calculations etc.

**Reference Book-**

1.Fundamental of Electric Machine : B.R. Gupta & Vandana Singhal

2.A Text Book of Electrical Technology: BL Theraja

**SUBJECT** : **MECHANICAL ENGINEERING**  
**CODE** : **EC/205** **MAX. MARKS** : **50**

1. Steam Engines: Classification, its parts and their functions, testing of engines.
2. Steam turbines: Classifications, Compounding, Specific steam consumptions, different types of efficiencies, Calculations. governing of steam tembins.
3. Reciprocating & Rotary Air Compressers, Classification, principle & operation calculation.
4. costing Ponds and costing towers:-  
Necessity of cooling the condenser water, condenser water cooling system. Introduction to cooling to cooling ponds, classification of cooling tower, presentation of carryover losses and fog formation from cooling towers, performance of cooling towers, etc.

**SUBJECT** : **INSTRUMENTATION**  
**CODE** : **SE/206** **MAX. MARKS** :  
**50**

1. Introduction to control system: Open loop and closed loop system. Types of control action such as- two step control, proportional control, integral control, proportional and integral control, derivative control and proportional, integral and derivative control. Pneumatic controller, Electronic controller.
2. Control Valve: Construction, types of body, flow characteristics of control valve, valve body material, selection of control valve & valve positioner.
3. Introduction to pressure switch and annunciation system.
4. De-superheating station: Pressure and temperature control..
5. Digital Technology: - Data Communication. Data Acquisition, PLC, DCS, Elements of a DCS. Data Highway, Digital field transmitter based on smart technology.
6. DCS/PLC control system and its application for mill and boiler control.
7. Basic parameters for auto combustion control and three element level control system for boilers.

**Reference Books**—1. Instrument Technology, Vol.1-4 by E.B. Jones,  
English Language Book Society Ltd., Butterworths  
2. Instrument Engineers Hand Book by B. G. Liptak,  
Butterworths Heinmann Ltd., Oxford

**SUBJECT : DRAWING & DESIGN**

**CODE : EC/207**

**MAX. MARKS : 100**

1. MILLS:

(A) THEORY: Design of mill roller shaft & shell, Design of rake carriers. Design of various feeding devices like under feed roller, Donnelly chute, Pressure feeders – G.R.P.F. and T.R.P.F.

(B) PRACTICAL Drawing of trash plate profile. Drawing of Donnelly chute and under feeder alongwith a three roller mill. Drawing of feed hopper, continuous pressure feeder alongwith three roller Mill.

2. PAN:

(A)THEORY

Objective and function of Pan

Design procedure of batch type Pan:- To calculate no. of tubes for given pan heating surface, dia of tube plate and down take, graining volume and strike level of pan, thickness of calendria shell & body. Design of catch-all and vapour pipe. Brief description of continuous pan.

(B)PRACTICAL

- i. Drawing of top and bottom tube plate, showing steam gullies, tie-rods, ventings, condensate removal etc.
- ii. Drawing of catch-all.
- iii. General arrangement drawing of pan.

3. CONDENSER:

(A)THEORY

Objective and function of condenser.

Design procedure of Barometric and multijet condensers: Baffle type, rain & shower type, Multijet condenser with separate spray & jet nozzle Barometre Condenser with box as well as combind jet and spray box. To calculate the dia and height of condenser, quantity of injection water required and air to be removed from the system, size of injection water and air pipe, size and no. of spray and jet nozzles in case of multijet condenser, size of tail pipe, size of sealing pipe etc.

(B)PRACTICAL

Drawing of Barometric and Multijet Condenser.- Seneral Arrangement

4. CRYSTALLIZERS:

(A)THEORY

Objective and function of crystallizers. Design procedure of air cooled and water cooled crystallizers :- Batch & Continuous. To calculate size of crystallizer, shaft dia, cooling surface for batch & continuous crystallizer.

(B)PRACTICAL

Drawing of water cooled crystallizer.

5. PRACTICAL

Practical on Computer Aided Drafting & Design in Auto Cad Lab.

**SUBJECT : SUGAR TECHNOLOGY (PRACTICAL)**  
**CODE : EC/208 MAX. MARKS : 50**

1. Determination of following constituents in juices & molasses:  
(i) Brix (ii) Pol (iii) Apparent purity (iv) pH (v) Reducing sugars  
(by Lane Eynon Method)
2. Determination of sucrose and calculation of gravity purity in juices and molasses  
By Jackson and Gills Method
3. Analyses of sugar for moisture per cent determination.
4. Analysis of bagasse for (i) pol per cent and (ii) Moisture percent.
5. Preparation of solutions and determination of sugar traces by  $\alpha$ - Naphthol Test in condensate water and boiler feed water.
6. Determination of pH in condensate water and boiler feed water.

**SUBJECT : MECHANICAL ENGINEERING**  
**CODE : EC/205 MAX. MARKS : 50**

5. Steam Engines: Classification, its parts and their functions, testing of engines.
6. Steam turbines: Classifications, Compounding, Specific steam consumptions, different types of efficiencies, Calculations. governing of steam tembins.
7. Reciprocating & Rotary Air Compressers, Classification, principle & operation calculation.
8. costing Ponds and costing towers:-  
Necessity of cooling the condenser water, condenser water cooling system. Introduction to cooling to cooling ponds, classification of cooling tower, presentation of carryover losses and fog formation from cooling towers, performance of cooling towers, etc.

**SUBJECT : INSTRUMENTATION**  
**CODE : SE/206 MAX. MARKS : 50**

1. Introduction to control system: Open loop and closed loop system. Types of control action such as- two step control, proportional control, integral control, proportional and integral control, derivative control and proportional, integral and derivative control. Pneumatic controller, Electronic controller.
2. Control Valve: Construction, types of body, flow characteristics of control valve, valve body material, selection of control valve & valve positioner.
3. Introduction to pressure switch and annunciation system.
4. De-superheating station: Pressure and temperature control..

8. Digital Technology: - Data Communication. Data Acquisition, PLC, DCS, Elements of a DCS. Data Highway, Digital field transmitter based on smart technology.
9. DCS/PLC control system and its application for mill and boiler control.
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Butterworths Heinmann Ltd., Oxford



**SUBJECT : DRAWING & DESIGN**

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**MAX. MARKS : 100**

1. MILLS:

(C) THEORY: Design of mill roller shaft & shell, Design of rake carriers. Design of various feeding devices like under feed roller, Donnelly chute, Pressure feeders – G.R.P.F. and T.R.P.F.

(D) PRACTICAL Drawing of trash plate profile. Drawing of Donnelly chute and under feeder alongwith a three roller mill. Drawing of feed hopper, continuous pressure feeder alongwith three roller Mill.

2. PAN:

(A)THEORY

Objective and function of Pan

Design procedure of batch type Pan:- To calculate no. of tubes for given pan heating surface, dia of tube plate and down take, graining volume and strike level of pan, thickness of calendria shell & body. Design of catch-all and vapour pipe. Brief description of continuous pan.

(B)PRACTICAL

iv. Drawing of top and bottom tube plate, showing steam gullies, tie-rods, ventings, condensate removal etc.

v. Drawing of catch-all.

vi. General arrangement drawing of pan.

4. CONDENSER:

(A)THEORY

Objective and function of condenser.

Design procedure of Barometric and multijet condensers: Baffle type, rain & shower type, Multijet condenser with separate spray & jet nozzle Barometre Condenser with box as well as combind jet and spray box. To calculate the dia and height of condenser, quantity of injection water required and air to be removed from the system, size of injection water and air pipe, size and no. of spray and jet nozzles in case of multijet condenser, size of tail pipe, size of sealing pipe etc.

(B)PRACTICAL

Drawing of Barometric and Multijet Condenser.- Seneral Arrangement

4. CRYSTALLIZERS:

(A)THEORY

Objective and function of crystallizers. Design procedure of air cooled and water cooled crystallizers :- Batch & Continuous. To calculate size of crystallizer, shaft dia, cooling surface for batch & continuous crystallizer.

(B)PRACTICAL

Drawing of water cooled crystallizer.

5. PRACTICAL

Practical on Computer Aided Drafting & Design in Auto Cad Lab.

**SUBJECT : SUGAR TECHNOLOGY (PRACTICAL)**  
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7. Determination of following constituents in juices & molasses:  
(i) Brix (ii) Pol (iii) Apparent purity (iv) pH (v) Reducing sugars  
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11. Preparation of solutions and determination of sugar traces by  $\alpha$ -Naphthol Test in condensate water and boiler feed water.
12. Determination of pH in condensate water and boiler feed water.