

# FACULTY OF SCIENCES

## SYLLABUS

FOR

### DIPLOMA COURSE IN PROCESS CONTROL IN SUGAR INDUSTRY (SEMESTER I-II)

Examinations: 2019 - 20



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**GURU NANAK DEV UNIVERSITY**  
**AMRITSAR**

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**DIPLOMA COURSE IN PROCESS CONTROL IN SUGAR INDUSTRY****Course Structure:**

**(i) Basic Course: 6-month**

**(ii) Diploma: 6-month+ 6-month= 1 year**

The Diploma/Advanced Certificate comprises Sl. No.(i) and (ii) as above.

The students of Advanced Certificate have to clear two examinations viz.

- i) after six months from the enrolment session and
- ii) after one year from the enrolment session

**DIPLOMA COURSE IN PROCESS CONTROL IN SUGAR INDUSTRY  
(SEMESTER SYSTEM)**

**Course Scheme**

PAPER	Skill Component / General Education	Subject Name	Hours per week			Credits	Total Marks	
			L	T	P		Theory	Practical
<b>Semester-I (Total marks: 500)</b>			<b>L</b>	<b>T</b>	<b>P</b>			
<b>Paper – I</b>	General Education	<b>Communication Skills-I</b>	2	0	3	6	40	60
<b>Paper – II</b>	General Education	<b>Computer Fundamentals</b>	2	0	3	6	40	60
<b>Paper – III</b>	Skill Component	<b>Sugarcane Agriculture Technology</b>	2	0	3	6	40	60
<b>Paper –IV</b>	Skill Component	<b>Instrumentation</b>	2	0	3	6	40	60
<b>Paper – V</b>	Skill Component	<b>Sugar Engineering</b>	2	0	3	6	40	60
			<b>25</b>			<b>30</b>		
<b>Semester-II (Total marks: 500)</b>								
<b>Paper – VI</b>	General Education	<b>Communication Skills-II</b>	2	0	3	6	40	60
<b>Paper –VII</b>	General Education	<b>Internet Applications and Tally</b>	2	0	3	6	40	60
<b>Paper – VIII</b>	Skill Component	<b>Chemical Engineering</b>	2	0	3	6	40	60
<b>Paper –IX</b>	Skill Component	<b>Equipment Drawing Design</b>	2	0	3	6	40	60
<b>Paper – X</b>	Skill Component	<b>Electrical Engineering</b>	2	0	3	6	40	60
			<b>25</b>			<b>30</b>		

**DIPLOMA COURSE IN PROCESS CONTROL IN SUGAR INDUSTRY (SEMESTER-I)****PAPER-I: COMMUNICATION SKILLS-I****Time: 3 hours****M. Marks: 100****Theory: 40****Practical: 60****Instructions for the Paper Setters:**

Eight questions of equal marks (Specified in the syllabus) are to be set, two in each of the four Sections (A-D). Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each Section. The fifth question may be attempted from any Section.

**NOTE: Instructions for Practical Exam: Entire syllabus will be covered for Practicals.**

**SECTION-A****Writing Skills**

Formatting personal and business letters:

1. Standard informal personal letters such as letters to parents, friends, social pillars.
2. Standard formal letters to Govt. Officers, superiors, utility purposes, News Paper Editors etc.
3. Standard Business Letters: Introducing and Promoting business activities, Placing an order, Cancelling an order, Reporting defects in receipt of ordered goods, Reporting delay in receipt of ordered goods, Responding to delay in supply of goods and services, Maintaining good customer relationships, Making customers give feedback to your services, Creating catalogue of your goods and services, Acknowledging services rendered by others,

**SECTION-B**

1. Resume Writing.
2. Writing of memos, notices and customer-friendly information.
3. Basic punctuation.
4. Blog writing

**SECTION-C****Speaking Skills**

1. Using courtesy words and expressions
2. Storing standard day to day usages sentences, words and expressions in mind.
3. Creating similar new sentences
4. Using declarative, imperatives, interrogative and exclamatory sentences.
5. Speaking catchy phrases , proverbs and expressions

**SECTION-D**

1. Differentiating confusing words
2. Making PowerPoint presentation
3. Making short speech
4. Group Discussion/ Conversation

**DIPLOMA COURSE IN PROCESS CONTROL IN SUGAR INDUSTRY (SEMESTER-I)****Suggested Readings/ Books :**

1. KK Ramchandran, et al Business Communication, Macmillan, New Delhi
2. Swati Samantaray, Business Communication and Communicative English, Sultan Chand, New Delhi.
3. S.P. Dhanavel English and Communication Skills for Students of Science and Engineering (with audio CD)
4. Computer Mediated Communication 1st Edition by Crispin Thurlow (, Lara Martin Lengel , Alice Tomic.
5. Collins, Patrick. Speak with Power and Confidence. New York: Sterling, 2009.
6. Fitikides, T. J. Common Mistakes in English. London: Orient Longman.

**DIPLOMA COURSE IN PROCESS CONTROL IN SUGAR INDUSTRY (SEMESTER-I)****PAPER-II: COMPUTER FUNDAMENTALS****Time: 3 hours****M. Marks: 100****Theory: 40****Practical: 60****Instructions for the Paper Setters:**

Eight questions of equal marks (Specified in the syllabus) are to be set, two in each of the four Sections (A-D). Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each Section. The fifth question may be attempted from any Section.

**NOTE: Instructions for Practical Exam: Entire syllabus will be covered for Practicals.**

**SECTION-A****Interacting with the computer:**

**Computer Components/ Input/ Output Devices:** Input devices; keyboard, mouse, scanner, output devices; vdu and printer (impact and non-impact printers), plotter etc. Primary and secondary storage (auxiliary storage), secondary storage; magnetic disks – tracks and sectors, optical disk (cd, cd-rw and dvd memory). **Computer Software concept:** System software, application software, operating systems, advantages of software and application packages. Introduction to operating systems such as ms-dos and windows, difference between dos and windows

**SECTION-B****Operating system-MS-Windows**

Operating system-Definition and functions, basics of Windows, Basic components of windows, icons, types of icons, taskbar, activating windows, using desktop, title bar, running applications, exploring computer, managing files and folders, copying and moving files and folders, Control panel – display properties, adding and removing software and hardware, setting date and time, screensaver and appearance, Using windows accessories.

**SECTION-C****Word Processor using Microsoft Office**

Introduction to Word, Introduction to Parts of Word Window (Title Bar, Menu Bar, Tool Bar, The Ruler, Status Area), Page Setup, Creating New Documents, Saving Documents, Opening an Existing documents, insert a second document into an open document, Editing and formatting in document, Headers and Footers, Spell Checking, Printing document, Creating a Table Using the Table Menu and table formatting, Borders and Shading, Templates and Wizards, Mail Merge, importing, exporting and inserting files, formatting pages, paragraphs and sections, indents and outdents, creating lists and numbering, Headings, styles, fonts and font size Editing, positioning and viewing texts, Finding and replacing text, inserting page breaks, page numbers , book marks, symbols and dates.

**Presentation Software using Microsoft Office**

Introduction to MS Power point, Power point elements, Templates, Wizards, Views, Exploring Power Point Menu, Working with Dialog Boxes, Adding Text, Adding Title, Moving Text Area, Resizing Text Boxes, Adding Art, Starting a New Slide, Starting Slide Show, Saving presentation; Printing Slides, Views (View slide sorter view, notes view, outlines view) Formatting and enhancing text formatting, Creating Graphs (Displaying slide show and adding multi – media)

**DIPLOMA COURSE IN PROCESS CONTROL IN SUGAR INDUSTRY (SEMESTER-I)****SECTION-D****Spreadsheet using Microsoft Office**

Elements of Electronics Spread Sheet and Ms-Excel: Application/usage of Electronic Spread Sheet, Opening of Spread Sheet, menu bar, Creation of cells and addressing of cells, Cell inputting.

Manipulation of cells: Enter texts numbers and dates, Creation of tables, Cell Height and Widths, Copying of cells.

Functions: Using functions: mathematical, statistical and financial function.

Spread sheets for Small accountings: Maintaining invoices/budgets, Totalling of various transactions, maintaining daily and monthly sales reports.

Charts: drawing different types of charts.

**Reference Books:**

1. Andrew S. Tanenbaum, David J. Wetherall Computer Networks (5th Edition),PHI.
2. P. K.Sinha, P. Sinha, Fundamentals of Computers, BPB Publishers.
3. A. Goel, Computer Fundamentals, Pearson Education.
4. Will Train, GiniCorter, Annette Marquis "Microsoft Office" BPB

**DIPLOMA COURSE IN PROCESS CONTROL IN SUGAR INDUSTRY (SEMESTER-I)****PAPER-III: SUGARCANE AGRICULTURE****Time: 3 hours****M. Marks: 100****Theory: 40****Practical: 60****Instructions for the Paper Setters:**

Eight questions of equal marks (Specified in the syllabus) are to be set, two in each of the four Sections (A-D). Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each Section. The fifth question may be attempted from any Section.

**NOTE: Instructions for Practical Exam: Entire syllabus will be covered for Practicals.**

**SECTION-A**

1. **Sugar Producing Crops:** History, origin and distribution of Sugarcane, Sugarcane producing countries in the world. Area under sugarcane in different states of India. Cultivation of sugarcane: Brief lectures on climatic requirements, preparation of land, period of sowing, cane seed, methods of planting, germination, tillering, irrigation and maturity of sugarcane crop. Nutrition of sugarcane: Major (macro) nutrients, Minor (Micro) nutrients, fertilizer management of sugarcane, Nitrogen, Phosphorus and Potash, sources and their applications: Morphology of sugarcane plant. Deterioration of sugarcane- effect of staling and burnt cane on fibre content. Plant Protection Measures for sugarcane- major diseases and pests of sugarcane and their integrated control measures. Characteristics of the sugarcane fibre. Mechanization of sugarcane cultivation, harvesting and transportation.

**SECTION-B**

2. **Juice extraction from cane** maceration / imbibitions, use of cold and hot water, maceration/imbibition scheme, mills sanitation, Measuring and weighing of juice, measuring tanks, level meters, counters, weighing machines ; hand operated, semiautomatic and automatic system for online weighment, Juice heaters, use of vapour and steam. Object of clarification, flow diagram of different processes, composition of sugarcane and juice, Lime kilns; lime preparation system; SO<sub>2</sub> production units; reaction tanks; settling tanks; continuous clarifiers/subsiders, i.e. Rapi Dorr, Graver & short retention types etc., plate and frame filter presses, bag filter, rotary vacuum filter & decanter etc, Sugar Manufacture: Evaporation- control and process, single effect and multiple effect evaporation, vapour cell, vapour bleeding, Scale formation their removal and effect on the efficiency of evaporation, removal of condensate and incondensable gases. Brix measurement devices. Syrup treatment.

**SECTION-C**

3. **Milling Control:** Method of control-differential and inferential control, primary and secondary mill extraction; Brix curves; Java system of chemical control; Dirt and foam corrections, pol accounts, Bx accounts, Miscellaneous calculations; Mill sanitation- E.R.Q.V. (MJ/PJ & LMJ/PJ) etc, Capacity: Selection of site, lay out plan of the factory, Cane feeding, cane carrier its width, length and drive, cane preparatory devices, power required for cane preparation and mills, Crushing capacity for milling tandems, mill drive power, raw Juice and maceration pump capacities.

**SECTION-D**

4. **Mixed Juice screening:** mixed juice weighing scale, mixed juice measuring tanks Juice heaters-for their heating surface, capacity of juice sulphitation tanks, sulphur furnaces, air compressors, lime kiln, milk of lime preparation units and pumps Clarifiers (settling tanks), rotary vacuum filters insulphitation, filter presses Evaporators, syrup sulphitation tanks



**DIPLOMA COURSE IN PROCESS CONTROL IN SUGAR INDUSTRY (SEMESTER-I)****PAPER-IV: INSTRUMENTATION****Time: 3 hours****M. Marks: 100****Theory: 40****Practical: 60****Instructions for the Paper Setters:**

Eight questions of equal marks (Specified in the syllabus) are to be set, two in each of the four Sections (A-D). Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each Section. The fifth question may be attempted from any Section.

**NOTE: Instructions for Practical Exam: Entire syllabus will be covered for Practicals.**

## SECTION-A

1. **Terminology:** Term associated with Instrument Technology like accuracy, precision, calibration etc. Pressure: Definition, different types of pressure like Gauge Pressure, Atmospheric Pressure and Absolute pressure, relation between them. Units of pressure, measurement of pressure, Pressure Indicator, Pressure Recorders. Vacuum: Definition, measurement of vacuum by vacuum gauge and U tube manometer. Elastic devices: Bourdon tube, Diaphragm and Bellows, construction and working of a 'C' type Bourdon tube pressure gauge, construction and working of vacuum gauges, its error and how to remove them. Application of Diaphragm and Bellows.

## SECTION-B

2. **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. Its merits and demerits and range of application. Resistance thermometer: Elements, construction, working and application. Thermocouple: different types, ranges, construction, working and application. Pyrometer: Definition, different types, construction, working and application. Measurement of flow: Orifice Plate, Flow measurement with the help of orifice plate. Accuracy and area of application. Rotameter: construction, working theory and application. Electromagnetic Flowmeter: Working principle, construction, maintenance, area of application.

## SECTION-C

3. **Measurement of level:** Sight gauge glass, counterweight type, air purge type, Buoyancy type. Measurement of pH: Construction of electrodes, maintenance of electrodes, circuit diagram. Boiler Instrumentation: Pressure measurement of steam, use of pig tail siphon for such measurement. Flow measurement of steam by orifice plate and differential pressure transmitter. Use of condensate pot for such measurement. Boiler drum level measurement by sight gauge glass method. Draft gauges. Flue gas temperature, steam temperature, boiler feed water temperature measurement by Thermocouple. Flue gas analysis by CO<sub>2</sub>, O<sub>2</sub> and CO by Orsat apparatus and on line measurement.

## SECTION-D

4. **Basic principles of process engineering & design:** General features of sugar manufacturing process and equipments. Structures and buildings-open and sheltered structures, gravity plants. Engineering economics: Economic criteria in process engineering and design. Measures of profitability. Depreciation, amortization, capitalized costs and present and future value and internal rate of return. Project evaluation. Energy economics and carbon credits.

**DIPLOMA COURSE IN PROCESS CONTROL IN SUGAR INDUSTRY (SEMESTER-I)****PAPER-V: SUGAR ENGINEERING****Time: 3 hours****M. Marks: 100****Theory: 40****Practical: 60****Instructions for the Paper Setters:**

Eight questions of equal marks (Specified in the syllabus) are to be set, two in each of the four Sections (A-D). Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each Section. The fifth question may be attempted from any Section.

**NOTE: Instructions for Practical Exam: Entire syllabus will be covered for Practicals.**

## SECTION-A

**1. Cane handling**

Unloading of cane by different systems and equipments. Overhead traveling crane (two and three motion grab and sling bar system), rakes, truck-tipler, lateral feeder table, auxiliary cane carrier (dimension, speed and power).

**2. Cane carrier**

Determination of slope, length, speed width and power consumption. Different methods of drives, cane carrier controls, equalizer (speed and power).

**3. Cane preparation**

Principle and design of different types of knives, kicker, chopper, leveler and cutter, fibrizer, shredders, mincer. Methods of their drives i.e., steam engines/steam turbines/ electric motors. Types of couplings, speed of rotation and power requirement- principle, different types; methods of drives, speed and power requirement of shredder and Mincer. Assessment of bulk density and preparatory index and their methods of analysis.

**4. Mills**

Function, different types of housings, square housing, inclined housing, self setting mill, cast steel and fabricated housing; trash plate and its function, trash beam, mill rollers, bearings, pinions, roller scrappers, juicerings.

**5. Pressure inmilling**

Pressure-volume relationship, reabsorption factor, compression ratio, filling ratio, fibre loading, specific fibre loading, hydraulic pressure, specific hydraulic pressure, polygon of forces in a mill, distribution of pressure on feed and discharge rollers, equation for the pressure developed on a roller, pressure regulating appliances - hydraulic, Accumulators (dead weight, pneumatic and air oil type). Calculations of hydraulic pressure, sequence of hydraulic pressure in the milling tandem, horizontal reaction and measure to control, pinion reaction and measures to control.

## SECTION-B

**6. Imbibition**

Principle, different systems of imbibition, methods of application of imbibition, hot and cold imbibition, optimum imbibitions and its efficiency.

**7. Mill capacity and performance**

Factors affecting mill capacity and performance such as cane preparation, specific hydraulic loading, length of tandem, roller speed, specific fibre loading and imbibitions

## SECTION-C

**8. Diffusers**

Types of diffusers - D.D.S. diffuser, Desmet diffuser, B.M.A diffuser, silver ring diffuser and Saturne diffuser- their description, retention time, power and steam requirement, capacity, automatic controls, treatment of their juices, their merits and demerits.

**DIPLOMA COURSE IN PROCESS CONTROL IN SUGAR INDUSTRY (SEMESTER-I)****9. Fine bagasse separators**

Different types of separators - stationary screens and drag type conveyors, vibrating screens, D.S.M. screens, rotary screens, their application, advantages and disadvantages.

**10. Combustion of fuels**

Chemical composition of bagasse, air for combustion, products of combustion, excess air and percentage of CO<sub>2</sub>. Calorific value- gross calorific value and net calorific value, heat loss in flue gases, loss due to incomplete combustion.

**11. Furnace**

Different types of furnaces for bagasse, i.e., step grate, horse shoe, ward, spreader stoker, travelling and dumping grate. Requirement of grate area, furnace volume, combustion chamber volume and application of secondary air. Performance of different types of furnaces- capacity of burning of fuel per unit grate area. Limitation of these furnaces and their relative merits and demerits.

**12. Boiler heat balance**

Boiler efficiency, condensation loss, sensible heat loss, unburnt and unknown losses. Estimated quantity of steam obtainable, weight of steam per unit weight of fuel. Typical examples, observations and analysis for determination of boiler efficiency. Methods of improving the boiler efficiency.

**13. Superheaters**

Different types of super heaters – convection and radiation, their location in the flue path. Calculation of heating surface, degree of superheat.

**14. Economiser**

Different types of economizer -vertical and horizontal, plain tubes and finned tubes, their merits and demerits, role and limitations in improving boiler plant efficiency, assessment of fuel saving, determination of heating surface and checking the performance of an existing installation.

## SECTION-D

**15. Airheaters**

Different types of air heaters - Tubular and plate type. Limitations of these air heaters. Determination of heating surface, checking of the performance of existing installation. Flue gas recirculation, comparison between air heater and economizer. Possibilities of installation of air heaters and economizer in a boiler plant.

**16. Draught**

Natural and artificial draught, balanced draught, chimney-location, calculation of height and cross-sectional area. Mechanical draught systems- forced and induced draught, ejector draught. Types of impeller blades, fan and their efficiencies, capacities of different fans and their power requirement.

**17. Feed water**

Use of condensate, make up water, temporary and permanent hardness, oil condensate. Method of treatment. Internal treatment of boiler compounds. External treatment-water softener and de-mineralization plants. The effect of oxygen on corrosion, de-aerators. Caustic embrittlement.

**18. Pressure reducing and desuperheating of steam**

Their description and working, merits and demerits, typical layout of steam reducing valves and precautions for their smooth operations. Need of a de-superheater, typical layouts and design of de-superheater.

**19. High pressure boilers**

Boilers. Advantages of high pressure boilers

**DIPLOMA COURSE IN PROCESS CONTROL IN SUGAR INDUSTRY (SEMESTER-II)****PAPER-VI: COMMUNICATION SKILLS-II****Time: 3 hours****M. Marks: 100****Theory: 40****Practical: 60****Instructions for the Paper Setters:**

Eight questions of equal marks (Specified in the syllabus) are to be set, two in each of the four Sections (A-D). Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each Section. The fifth question may be attempted from any Section.

**NOTE: Instructions for Practical Exam: Entire syllabus will be covered for Practicals.**

**SECTION-A****Reading Skills**

1. Newspaper reading skills
2. Content reading through internet sources
3. Comprehension Passages

**SECTION-B****Listening Skills**

1. Receiving voice calls
2. Attending active phone calls and responding
3. Daily news listening exercises (Audio and Video)
4. Note taking
5. Listening to native speakers conversations.

**SECTION-C****Common mistakes**

1. How to avoid common mistakes in: Nouns, Pronouns, Adjectives, Adverbs, Prepositions, word usage, helping verbs, verbs, phrases, clauses and sentences

**SECTION-D****Foreign Words**

1. Frequently used foreign words.

**Advertisement Writing**

1. Classified, Display, Boxed, Billboard, Online

**Suggested Readings/ Books**

1. KK Ramchandran, et al Business Communication, Macmillan, New Delhi
2. Swati Samantaray, Business Communication and Communicative English, Sultan Chand, New Delhi.
3. S.P. Dhanavel English and Communication Skills for Students of Science and Engineering (with audio CD)
4. Computer Mediated Communication 1<sup>st</sup> Edition by Crispin Thurlow (Lara Martin Lengel, Alice Tomic.
5. Collins, Patrick. Speak with Power and Confidence. New York: Sterling, 2009.
6. Fitikides, T. J. Common Mistakes in English. London: Orient Longman.

**DIPLOMA COURSE IN PROCESS CONTROL IN SUGAR INDUSTRY (SEMESTER-II)****PAPER-VII: INTERNET APPLICATION AND TALLY****Time: 3 hours****M. Marks: 100****Theory: 40****Practical: 60****Instructions for the Paper Setters:**

Eight questions of equal marks (Specified in the syllabus) are to be set, two in each of the four Sections (A-D). Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each Section. The fifth question may be attempted from any Section.

**NOTE: Instructions for Practical Exam: Entire syllabus will be covered for Practicals.**

**SECTION-A**

**Introduction to networks:** Network Definition, Basic Components of a Network, Network types and topologies, Uses of Computer Networks, Network Architecture.

Transmission Media: Coaxial cable, twisted pair cable, fiber optics and satellites. OSI reference model, TCP/IP reference model, comparison of OSI and TCP reference model.

**SECTION-B*****Computer Communication***

**Basic of Computer networks:** LAN, WAN, MAN.

Internet: Introduction to internet and its application/services.

Service on Internet: WWW and web-sites, Electronic mails, Communication on Internet.

**Web Browsers:** Internet Explorer, Chrome and Firefox

Surfing the Internet: Giving the URL address, Search, Moving Around in a web-site, Printing or saving portion of web pages, down loading/uploading

Chatting on Internet

**SECTION-C**

**Email:** Basic of electronic mail, Creating Email id, Mailbox: Inbox and outbox. Using Emails: Viewing an email, sending an Email, Saving mails, sending same mail to various users, Document handling: Sending soft copy as attachment, Enclosures to email, sending a Portion of document as email

**SECTION-D**

**Tally: Introduction to financial accounting:** accounting concepts.

**Financial accounting basics:** company creation, accounts configuration, accounts classification, accounts master, creations of voucher, types and classes, accounts vouchers.

**Financial accounting advanced:** final accounts, bank reconciliation statement

**Inventory:** introduction to inventory, stock groups, stock categories, stock item, reorder levels, locations / go downs, units of measure, price list, tariff classification, dealer excise, opening stock, pure inventory voucher, entry of pure inventory voucher, bill of material, purchase and sales order, foreign exchange transactions.

**Business management:** New Year books, MIS reports, budget management, scenario management.

**REFERENCE BOOKS:**

1. Tanenbaum A. S., "Computer Networks", PHI.
2. TALLY ERP 9 TRAINING GUIDE - 4<sup>th</sup> REVISED and UPDATED EDITION – 2018

**PAPER-VIII: CHEMICAL ENGINEERING****Time: 3 hours****M. Marks: 100****Theory: 40****Practical: 60****Instructions for the Paper Setters:**

Eight questions of equal marks (Specified in the syllabus) are to be set, two in each of the four Sections (A-D). Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each Section. The fifth question may be attempted from any Section.

**NOTE: Instructions for Practical Exam: Entire syllabus will be covered for Practicals.**

**SECTION-A**

**Introduction to Chemical Engineering:** Concept of unit operations and unit processes. Unit operations and processes in sugar manufacture. Mass and energy balance computation and application to sulphur burners, steam generation process. Enthalpy balances in evaporator systems.

**SECTION-B**

**Process Fluid Mechanics:** Classification of fluids and fluid flow phenomena. Non-Newtonian fluids in sugar industry practice. Bernoulli's Theorem and its applications to compressible and incompressible process fluids. Process pumps-classification, selection and sizing. Parallel and series arrangement. Pumping practice in sugar manufacture.

**SECTION-C**

**Process Piping and Pipe Components:** Pipeline sizing for steam and condensates; juices, molasses and massecuites as per standards and codes (ASME 31.3)-Modes of failure of piping systems. Piping networks.

**SECTION-D**

**Process Heat Transfer:** Convective and radiant heat transfer. Boiling and condensation. Effect of sugar process and operating conditions. Selection and sizing of heat exchange equipments- heaters, condensers and condensate heat recovery systems, evaporators- single and multiple effect evaporators.

**DIPLOMA COURSE IN PROCESS CONTROL IN SUGAR INDUSTRY (SEMESTER-II)****PAPER-IX: EQUIPMENT DRAWING DESIGN****Time: 3 hours****M. Marks: 100****Theory: 40****Practical: 60****Instructions for the Paper Setters:**

Eight questions of equal marks (Specified in the syllabus) are to be set, two in each of the four Sections (A-D). Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each Section. The fifth question may be attempted from any Section.

**NOTE: Instructions for Practical Exam: Entire syllabus will be covered for Practicals.**

## SECTION-A

1. **General Design Considerations:** functional design, Production design & Maintenance design. Economic considerations. Methods of fabrications: fusion welding, welding standards. Types of welded joints, Fillet and Butt joint and their details. Calculation of strength of different welding joints. General Design Procedures: Study of B.I.S. codes, their application to the equipment. Failure criterion- excessive elastic deformation, elastic instability, plastic instability, brittle rupture, creep & corrosion.

## SECTION-B

2. **JUICE HEATER:** Functional and constructional details, material of construction and its properties, various types of juice heaters-dead end & Dynamic juice heaters. Forgiven crushing rate, calculation of heating surface, total number of tubes, number of tubes per pass, number of passes, number of compartments, diameter of tube plate, size of steam inlet, juice inlet/outlet, condensate outlet, non condensable gas outlet : Thickness of tube plate, calendria shell, cover plates, etc.

## SECTION-C

3. **EVAPORATOR:** Types : Robert, Semikestner, Functional and constructional details, Material of construction and its properties, For given heating surface determination of total number of tubes, diameter of tube plate, diameter of down –take, body diameter and height, calendria shell thickness, tube plate thickness, body thickness. Calculation of vapour inlet, juice inlet/outlet, condensate outlet, non condensable gas outlets. Design of internal catchall.

## SECTION-D

4. **FINAL MOLASSES TANK:** Constructional and functional details, material of construction and it properties. Determination of number and capacity of molasses tanks for a given capacity of sugar factory. Calculation of optimum tank proportion, Diameter of tank, filling height and total height of tank, number and thickness of each course, standard width of courses, thickness of bottom plate.
5. **MILLS:** Design of mill roller – shaft journals and shell. Theory of failure of mill rollers.

**DIPLOMA COURSE IN PROCESS CONTROL IN SUGAR INDUSTRY (SEMESTER-II)****PAPER-X: ELECTRICAL ENGINEERING****Time: 3 hours****M. Marks: 100****Theory: 40****Practical: 60****Instructions for the Paper Setters:**

Eight questions of equal marks (Specified in the syllabus) are to be set, two in each of the four Sections (A-D). Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each Section. The fifth question may be attempted from any Section.

**NOTE: Instructions for Practical Exam: Entire syllabus will be covered for Practicals.**

**SECTION-A**

1. **Transformers:** basic principles, classification, auto transformers.
2. **D.C. Machines:** Generator, motoring principles, series, shunt and compound generators, series, shunt and compound motors, their use as variable speed drives, starting and speed control schemes.

**SECTION-B**

3. **A.C. Machines:** Induction Motors: Theory of induction motors, single phase, two phase, three phase characteristics, slip torque relationships, construction of squirrel cage and slip ring induction motors, advantages and disadvantages of both types, three phase starters- direct on line, star-delta and auto-transformer, speed regulation, techniques for slip ring motor.

**SECTION-C**

4. **Power Factor Improvement:** disadvantages of low power factor; reasons for low power factor correction; capacitors, motors in a sugar factory and remedial measures to improve the power factor.

**SECTION-D**

5. **Advantage and disadvantage of DC drive:** AC variable voltage and variable frequency control system, Measures to reduce total power consumption in sugar industry to around 22 kW for electrical drive system