

DETAILED SYLLABUS  
**FOR DISTANCE EDUCATION**

Under Graduate Degree Program

**Diploma**  
(Chemical Engineering)

(SEMESTER SYSTEM)

**COURSE TITLE**  
**DURATION**

**: Diploma in Chemical Engineering (DCHME)**  
**: 03 Years (Semester System)**

**FIRST SEMESTER**

COURSE TITLE	MARKS				TO-TAL
	THEORY		PRACTICAL		
	INTER-NAL	EXTER-NAL	INTER-NAL	EXTER-NAL	
APPLIED MATHEMATICS I	40	60			100
PHYSICS	40	60			100
CHEMISTRY	40	60			100
FUNDAMENTALS OF COMPUTERS	40	60			100
COMMUNICATION TECHNIQUES	40	60			100

**SECOND SEMESTER**

COURSE TITLE	MARKS				TO-TAL
	THEORY		PRACTICAL		
	INTER-NAL	EXTER-NAL	INTER-NAL	EXTER-NAL	
APPLIED MATHEMATICS II	40	60			100
BASIC MECHANICAL ENGINEERING	40	60			100
BASIC ELECTRICAL ENGINEERING	40	60			100
BASIC ELECTRONICS	40	60			100
ENGINEERING DRAWING	40	60			100

**THIRD SEMESTER**

COURSE TITLE	MARKS				TO-TAL
	THEORY		PRACTICAL		
	INTER-NAL	EXTER-NAL	INTER-NAL	EXTER-NAL	
THERMODYNAMICS	40	60			100
TRANSPORT PROCESSES -I	40	60			100
NON CONVENTIONAL ENERGY ENGINEERING	40	60			100

ELECTRICAL MACHINES	40	60			100
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### **FORTH SEMESTER**

COURSE TITLE	MARKS				TO-TAL
	THEORY		PRACTICAL		
	INTER-NAL	EXTER-NAL	INTER-NAL	EXTER-NAL	
SOCIETY, ENVIRONMENT & ENGINEERING	40	60			100
INTRODUCTION TO PROCESS CALCULATION AND FLOWSHEETING	40	60			100
HEAT TRANSFER	40	60			100
ORGANIC & INORGANIC CHEMISTRY	40	60			100

### **FIFTH SEMESTER**

COURSE TITLE	MARKS				TO-TAL
	THEORY		PRACTICAL		
	INTER-NAL	EXTER-NAL	INTER-NAL	EXTER-NAL	
	40	60			100
	40	60			100
	40	60			100
	40	60			100

### **SIXTH SEMESTER**

COURSE TITLE	MARKS				TO-TAL
	THEORY		PRACTICAL		
	INTER-NAL	EXTER-NAL	INTER-NAL	EXTER-NAL	
	40	60			100
	40	60			100
	40	60			100
	40	60			100

**SYLLABUS**  
**DIPLOMA IN CHEMICAL ENGINEERING**  
**SEMESTER – I**

**APPLIED MATHEMATICS I**

**Sub. Code:**

**Credits: 02**

**Total Marks: 100**

**Minimum Pass Marks: 40%**

**Internal Assessment: 40 Marks**

**University Examination: 60 Marks**

**BLOCK I**

**Unit 1: Algebra - 1**

Application of Quadratic Equations; Simultaneous Equations (One Linear and Other Quadratic Equation) in Two Variables to Engineering Problems. Arithmetic Progression, its  $n$ th Term and Sum of  $n$  Terms with their Applications to Engineering Problems. Geometrical Progression, its  $n$ th Term and Sum of  $n$  Terms and to Infinity with Application to Engineering Problems.

**Unit 2: Algebra – 2**

Partial Fractions (Excluding Repeated Quadratic Factors)

Introduction to Permutations & Combinations; Applications of Formulae. Binomial Theorem (Expansion without Proof) for Positive Integral Index (Expansion and General Term); Binomial Theorem for any Index (Expansion without Proof only); First and Second Binomial Approximation with Application to Engineering Problems. Logarithm General Properties of Logarithms, Calculations of Engineering Problems using Log Tables

**Unit 3: Determinants and Matrices**

Determinants and Matrices-Expansion of Determinants (up to Third Order) using Sarrus Rule, Expansion Method and Pivotal's Condensation Method; .Properties of Determinants; Solutions of Equations (up to 3 unknowns) by Cramer's Rule; Definition of Matrix; Addition, Subtraction and Multiplication of Matrices (up to Third Order); .Inverse of a Matrix by Ad-joint Method and Elementary Row Transformations. Solution of Equations (up to 3 unknowns) by Matrix Method

## **BLOCK II**

### **Unit 4: Trigonometry**

Addition and Subtraction Formulae; Product Formulae and their Application in Engineering Problems; Transformation from Product to Sum or Difference of Two Angles and vice versa; Multiple and Sub-multiple Angles. Conditional Identities; Solution of Triangles (excluding Ambiguous Cases). Graphs of  $\sin x$ ,  $\cos x$ ,  $\tan x$  and  $e^x$

### **Unit 5: Vectors**

Definition of Vector and Scalar Quantities; Addition and Subtraction of Vectors; Dot Product and Cross Product of Two Vectors; .Thumb Rule; Angle between Two Vectors; Application of Dot and Cross Product in Engineering Problems

### **Unit 6: Complex Numbers**

Definition; Real and Imaginary Parts of a Complex Number; Polar and Cartesian Representation of a Complex Number and Conversion from One to the Other; Conjugate of a Complex Number; Modules and Argument of a Complex Number.

### **Suggested Readings:**

1. Higher Engineering Mathematics, B.S. Grewal, Khanna Publishers.
2. Mathematics Vol. I, SS Sabharwal et. al., Eagle Prakashan.
3. Mathematics Vol. II, SS Sabharwal et. al., Eagle Prakashan
4. Advanced Engineering Mathematics, A B Mathur and V.P. Jagi; Khanna Publishers.
5. Engineering Mathematics, C Dass Chawla, Asian Publisher.
6. Engineering Mathematics, S Kohli and others, IPH.

### **Note:**

1. Eight questions are to be set, at least one question from each unit. Students will have to attempt five questions in all.
2. Use of non-programmable scientific calculator is allowed in Examination Hall.

**SYLLABUS**  
**DIPLOMA IN CHEMICAL ENGINEERING**  
**SEMESTER – I**

**PHYSICS**

**Sub. Code:**

**Credits: 02**

**Total Marks: 100**

**Minimum Pass Marks: 40%**

**Internal Assessment: 40 Marks**

**University Examination: 60 Marks**

**BLOCK I:**

**Unit 1: Units & Dimensions**

Fundamental and Derived Units in SI System; Dimensions of Physical Quantities; Principle of Homogeneity; Dimensional Equation; Applications of Dimensional Analysis; Checking the Correctness of Physical Equations; Derivation of Simple Physical Relations; Limitation of Dimensional Analysis.

**Unit 2: Force & Motion**

Scalars and Vectors; Velocity & Acceleration; Equations of Motion; Newton's Laws of Motion; Composition and Resolution of Forces; Motion of Projectiles: Parabolic Motion, Trajectory, Time of Flight, Horizontal Range and Maximum Horizontal Range, Centripetal Acceleration; Centripetal and Centrifugal Forces; Concept of Friction..

**Unit 3: Work, Power and Energy**

Work and its Units; Work Done on Bodies Moving on Horizontal and Inclined Planes; Concept of Power and its Units; Calculations of Power (Simple Cases); Concept of Kinetic Energy and Potential Energy; Law of Conservation of Energy; Conservation of Energy in Case of Freely Falling Bodies.

**Unit 4: Waves and Vibrations**

Simple Harmonic Motion (SHM): Definition, Dynamics of Simple Harmonic Motion; Energy of Simple Harmonic Motion; Vibration: Types of Vibration; Vibration Analysis: Free Vibration without Damping, Free Vibration with Damping, Forced Vibration, Resonant Vibration; Wave Motion: Types of Wave, Transverse and Longitudinal and Surface Wave, Relation between Velocity of Wave, Frequency and Wave Length of a Wave; Sound and Light Waves; Applications of Sound Waves in Engineering.

**BLOCK II**

**Unit 5: Heat**

Concept of Heat and Temperature; Unit of Temperature; Basic Principles and Methods of Measurement of Temperature: Thermocouple, Resistance and Bimetallic Thermometer, Pyrometers, Clinical and other Thermometers; Three Modes of Transfer of Heat: Conduction, Convection, Radiation, Coefficient of Thermal Conductivity, Thermal Resistance; Expansion of Solids: Linear

thermal expansion coefficient, Surface thermal expansion coefficient, Volume thermal expansion coefficient, Relation amongst Three thermal expansion coefficients; Heat Radiation: Characteristics of Heat Radiation; Prevost's Theory; Black Body Radiations: Emissivity and Absorbivity, Kirchoff's Law, Stefan's Law.

### **Unit 6: Principle of Optics**

Reflection of Light: Laws of Reflection; Refraction of Light: Refractive Index; Concept of Mirror: Convex Mirror, Concave Mirror, Mirror Equation and Magnification; Concept of Lens: Lens Formulae, Real and Virtual Image, Magnification Power of Lens; Simple and Compound Microscope; Optical Telescope; Total Internal Reflection: Critical Angle, Conditions for Internal Reflection

### **Unit 7: Electrostatics**

Coulombs Law: Electric and Magnetic Constants, Unit Charge, Electric Field, Electric Field of Point Charge, Electric Flux; Gauss's Law: Electric Field of Point Charge, Electric Field of Conducting Sphere, Electric Field: Outside a Sphere of Uniform Charge, Electric Field: Inside a Sphere of Charge, Electric Field of Line Charge, Electric Field: Conducting Cylinder, Electric Field: Sheet of Charge, Electric Field: Parallel Plates.

### **Unit 8: Electricity and Magnetism**

Ohm's Law: Specific Resistance; Kirchoff's Laws; Wheatstone Bridge: Operation and Significance; Joule Effect - Heating Effect of Current: Concept of Electric Power; Magnetic Fields and Forces; Magnetic Fields due to Current; Ampere's Law; Faraday's Law of Induction: Lenz's Law, Self Induction, Mutual Induction

### **Suggested Readings:**

1. Applied Physics Vol. I & II, TTTI Publication Tata McGraw Hill.
2. Basic Applied Physics, RK Gaur; Dhanpat Rai and Co.
3. Numerical Problems in Physics: Volume I and II by RS Bharaj; Tata McGraw Hill
4. Text book of Physics, Vol. I & II, Resnik and Halliday, Wiley India.
5. Engineering Physics, R. Gaur & S. L. Gupta, Dhanpat Rai and Co.

### **Note:**

1. Eight questions are to be set. Students will have to attempt five questions in all.
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**SYLLABUS**  
**DIPLOMA IN CHEMICAL ENGINEERING**  
**SEMESTER – I**

**CHEMISTRY**

**Sub. Code:**

**Credits: 02**

**Total Marks: 100**

**Minimum Pass Marks: 40%**

**Internal Assessment: 40 Marks**

**University Examination: 60 Marks**

**BLOCK I**

**Unit 1: Structure of Atom**

Introduction; Fundamental Particles of Atom; Electron, Proton and Neutron.; Bohr's Model of Hydrogen Atom; Line Spectrum of Hydrogen Atom; Limitation of Bohr's Model; Modern Concept of Atom; Four Quantum Numbers; Pauli's Exclusion Principle; Types of Bonds; Modern Periodic Table of Elements.

**Unit 2: Chemical Equation, Oxidation & Reduction**

Basic Concept of Elements; Mixture and Compound; Chemical Equation, its Balancing; Implications and Limitations.

Concept of Oxidation & Reduction: Electronic Concept of Oxidation and Reduction, Redox Reactions (Direct and Indirect), Oxidation No, Balancing of Simple Redox Reactions by Oxidation No.

**Unit 3: Ionic Equilibrium**

Ionization; Degree of Ionization; Focus Effecting Ionization; Ionization of Water; Ionization Equilibrium in Aqueous Solutions; Common Ion Effect.

**BLOCK II**

**Unit 4: Acids & Bases**

Concept of Acids and Bases & their Strength in Ionization Constant; PH Value; Acid Base Titration; Choice of Indicators; Hydrolysis; Buffer Solution.

**Unit 5: Electrolysis:**

Introduction; Concept of Electrolysis; Faraday's Law of Electrolysis; Engineering Applications; (Electro-Metallurgy; Electroplating & Electro-Refining).

**Unit 6: Water**

Hard and Soft Water; Removal of Hardness by A) Soda Lime Process), Permutit's Process, C). Ion Exchange Method.

Disadvantages of Hard Water in Industrial Use; Boiler Scales; Priming; Foaming Corrosion and Caustic Embitterment; Expressing the Degree of Hardness of Water in (with Simple Problems): A) Clark's Degree, B) O'Hener's Method; Determination of Degree of Hardness by (with Simple Problems): A) Soap Titration Method, B) O'Hener's Method; Water for Drinking Purposes.

### **Unit 7: Solutions & Colloids:**

Solute; Solvent; Solution & Colloids; Particle Size and Colloidal State; Tyndell Effect; Brownian Movement; Coagulation.

### **Suggested Readings:**

1. Chemistry in Engineering, J.C. Kuriacose and J. Rajaram, Tata McGraw-Hill.
2. Chemistry in Engineering, Dr. S. Rabindra and Prof. B.K. Mishra, Kumar and Kumar Publishers.
3. A Text Book of Applied Chemistry-I, SS Kumar, Tata McGraw Hill.
4. A Text Book of Applied Chemistry-I, Sharma and Others, Technical Bureau of India.

### **Note:**

1. Eight questions are to be set. Students will have to attempt five questions in all.
2. Use of non-programmable scientific calculator is allowed in Examination Hall

**SYLLABUS  
DIPLOMA IN CHEMICAL ENGINEERING  
SEMESTER – I**

**FUNDAMENTALS OF COMPUTERS**

**Sub. Code:**

**Credits: 02**

**Total Marks: 100**

**Minimum Pass Marks: 40%**

**Internal Assessment: 40 Marks**

**University Examination: 60 Marks**

**BLOCK I**

**Unit 1: Introduction to Computer System**

An Overview of the Computer System; the Processor (CU; ALU); Factors Affecting Processor Speed; the Bus: Data Bus and Address Bus; Memory (RAM; ROM; Registers; Cache).

**Unit 2: I/O Devices**

Introduction; I/O Devices: Mouse, Keyboard, Monitors, Printers, Pens, Touch, Screens, Microphones, and Voice Recognition; Storage Devices: Diskettes, Hard Disc, CD-ROM; Computer Categorization.

**Unit 3: Introduction to Networks**

Networks-Uses; Categories & Topologies; System Software and Application Software; Operating System; User Interface; Resource Management; Utility Software.

**BLOCK II**

**Unit 4: Introduction to Database Management**

Word Processing and Desktop Publishing; Spreadsheets; Basics of Database Management.

**Unit 5: Programming Languages**

Programming Language: High-level language, Low Level Language & Assembly language; Major Features of the Internet; Working with Graphics.

**Unit 6: Information Systems**

Types of Information Systems; System Development Life Cycle.

### **Suggested Readings:**

1. Computer Fundamentals, P.K Sinha, BPB Publications.
2. Computers Today, Suresh .K Basandra, Galgotia Publications Private Ltd.
3. Computer Installation Troubleshooting, M. Radha Krishnan & D. Balasubramanian, ISTE Learning Material.
4. Computer Organization & Design, P. Pal Chaudhuri, Prentice Hall of India.

### **Note:**

1. Eight questions are to be set; at least one question from each unit. Students will have to attempt five questions in all.
2. Use of non-programmable scientific calculator is allowed in Examination Hall

**SYLLABUS**  
**DIPLOMA IN CHEMICAL ENGINEERING**  
**SEMESTER – I**

**COMMUNICATION TECHNIQUES**

**Sub. Code:**

**Credits: 02**

**Total Marks: 100**

**Minimum Pass Marks: 40%**

**Internal Assessment: 40 Marks**

**University Examination: 60 Marks**

**BLOCK I**

**Unit 1: Correspondence (Official, Business and Personal)**

One Letter from each Category - Official, Business and Personal may be set in the examination paper and the students be asked to write one of them.

**Unit 2: Grammar**

A Brief Review of Easy Form of Tenses; Conversion of Direct Narration into Indirect Form of Narration and Vice Versa (only Simple Sentences); Punctuation.

**Unit 3: Essay**

Preferably on Scientific Topic from the given outlines - the Paper Setter may be instructed to give a choice of attempting one out of three topics. The question paper may provide the outlines. The essay will be of 250 to 300 words. The examiner may select three topics one from each of the following.

- A) Science;
- B) Technology;
- C) General.

**Suggested Readings:**

1. Text Book on English and Communication Skills, Book-I, Kuldeep Jaidka et.al. Developed by NITTR, Chandigarh.
2. New Design English Grammar: Reading and Writing Skills, (Course A and course B), A. L. Kohli; Kohli Publishers.
3. New Design English Reading and Advanced Writing Skills for Class XI and XII, M. K Kohli and A. L Kohli, Kohli Publishers.

**Note:**

1. Six questions are to be set; at least one question from each unit. Students will have to attempt four questions in all.
2. Use of non-programmable scientific calculator is allowed in Examination Hall.

**SYLLABUS**  
**DIPLOMA IN CHEMICAL ENGINEERING**  
**SEMESTER – II**

**APPLIED MATHEMATICS II**

**Sub. Code:**

**Credits: 02**

**Total Marks: 100**

**Minimum Pass Marks: 40%**

**Internal Assessment: 40 Marks**

**University Examination: 60 Marks**

**BLOCK I**

**Unit 1: Co-ordinate Geometry -1**

Area of Triangle, Centroid and In centre of Triangle (given the Vertices of a Triangle), Simple Problems on Locus. Equation of Straight Lines in Various Forms (without Proof) with their Transformation from one to another; Angle between Two Lines and Perpendicular Distance Formula (without Proof).

**Unit 2: Co-ordinate Geometry -2**

Circle: General Equation and its Characteristics given:

- The Centre and Radius;
- Three points on it;
- The Co-ordinates of the end's of the diameter.

Conics: Parabola, Ellipse and Hyperbola; Standard Equation of Conics (without Proof); Given the Equation of Conics to Calculate Foci, Directrix, Eccentricity, Lotus Rectum, Vertices and Axis Related to Different Conics.

**Unit 3: Differential Calculus -1**

Concept of Function: Four Standard Limits:

$$\text{Lt } (x^n - a^n) / (x - a);$$

$$x \rightarrow a$$

$$\text{Lt } \sin x/x;$$

$$x \rightarrow 0$$

$$\text{Lt } (a^x - 1)/x;$$

$$x \rightarrow 0$$

$$\text{Lt } (1 + x)^{1/x}.$$

$$x \rightarrow 0$$

Concepts of Differentiation and its Physical Interpretation.

Differential by First Principle of  $x^n$ ,  $(ax + b)^n$ ,  $\sin x$ ,  $\cos x$ ,  $\tan x$ ,  $\text{cosec } x$  and  $\cot x$ ,  $e^x$ ,  $a^x$ ,  $\log x$

Differentiation of Sum, Product and Quotient of Different Functions.

Logarithmic Differentiation, Successive Differentiation excluding  $n^{\text{th}}$  order

**Unit 4: Differential Calculus - 2**

Application of Derivatives for (a) Rate Measure, (b) Errors, (c) Real Root by Newton's Method, (d) Equation of Tangent and Normal (e) Finding the Maxima and Minima of a Function (Simple Engineering Problems).

## **BLOCK II**

### **Unit 5: Integral Calculus - 1**

Integration as Inverse Operation of Differentiation.

Simple Integration by Substitution by Parts and by Partial Fractions

Evaluation of Definite Integrals (Simple Problems) by Expanding; the General Properties of Definite Integrals.

### **Unit 6: Integral Calculus - 2**

Application of Integration for Simple Problem on Evaluation of Area under a Curve where Limits are prescribed for Circle, Ellipse, Parabola and Straight Line. Calculation of Volume of a Solid formed by Revolution of an Area about Axis (Simple Problems) where Limits are prescribed for Sphere and Cylinder. To calculate Average and Root Mean Square of a Function. Area by Trapezoidal Rule and Simpson's Rule.

### **Unit 7: Differential Equations**

Solution of First Order and First Degree Differential Equation by Variable Separation and their Simple Numerical Problem.

### **Suggested Readings:**

1. Higher Engineering Mathematics, B.S. Grewal, Khanna Publishers.
2. Engineering Mathematics, C Dass, Chawla, Asian Publishers.
3. Engineering Mathematics, S. Dasgupta, McGraw-Hill.
4. Advanced Engineering Mathematics by A.B. Mathur and V.P Jaggi, Khanna Publishers.
5. Applied Mathematics Vol. II, RD Sharma, Khanna Publishers.
6. A text Book of Matrices, Shanti Narayan, S. Chand & Co.
7. Calculus and Analytical Geometry, Thomas/Finney, Narosa Publishing House.
8. Mathematics for Engineers, C.Prasad, Prasad Mudranalaya.
9. Differential & Integral Calculus, N Piskunov, Moscow Peace Publisher.
10. Higher Engineering Mathematics, Bird, J O, Butter worth-Heinemann.
11. Introduction to Engineering Mathematics, Croft, Davis & Hargreaves, Addison-Wesley.

### **Note:**

1. Eight questions are to be set. Students will have to attempt five questions in all.
2. Use of non-programmable scientific calculator is allowed in Examination Hall.

**SYLLABUS  
DIPLOMA IN CHEMICAL ENGINEERING  
SEMESTER – II**

**BASIC MECHANICAL ENGINEERING**

**Sub. Code:**

**Credits: 02**

**Total Marks: 100**

**Minimum Pass Marks: 40%**

**Internal Assessment: 40 Marks**

**University Examination: 60 Marks**

**BLOCK I**

**Unit 1: Mechanical Properties of Metals**

Definitions; Elasticity; Plasticity; Ductility; Brittleness; Toughness; Hardness; Malleability; Fatigue; Examples of Applications of above Terms Related to Engineering.

**Unit 2: Basic Concept of Thermal Engineering**

Energy: Internal Energy, Potential Energy, Kinetic Energy; Heat: Work and Enthalpy, Specific Heat, Specific Heat Ratio; Characteristics Gas Equation; Universal Gas Constant; First Law of Thermodynamics; Second Law of Thermodynamics.

**Unit 3: Hydraulics**

Physical Properties of a Fluid: Density, Specific Volume, Specific Weight, Specific Gravity Viscosity; Pascal's Law; Pressure Measuring Devices: Manometers, Simple Manometers, Differential Manometers, Inverted 'U' Tube, Pressure Gauges; Continuity Equation; Bernoulli's Theorem: Energy of a Fluid, Pressure Energy, Velocity Energy, Datum Energy; Venturimeter & its Uses.

**Unit 4: Pumps and Turbine**

Pumps: Types of Lumps, Centrifugal Pump, Reciprocation Pump, their Relative Advantages and Performance.

Turbine: Working Principles and Types of Water Turbines, Selection of Turbines, Brief Idea of Turbine, Pelton Wheel Turbine, Francis Turbine.

**BLOCK II**

**Unit 5: Properties of Steam**

Generation of Steam at Constant Pressure, Enthalpy of Water Wet Steam, Enthalpy of Dry Saturated Steam, Dryness Fraction, Superheated Steam, Latent Enthalpy, Enthalpy of Steam, Specific Volume, External Work During Evaporation, Internal Content Enthalpy, Internal Energy of Steam, Use of Steam Table



### **Unit 6: Boilers and Steam Turbines**

Boilers: Classification of Boilers, Working of Common Boilers, Babcox and Wilcox, Chichram Boiler, Boiler Mounting and their Accessories, Introduction to Modern High Pressure Boiler for Thermal Power Station: Lamont Boiler, Weffler Boiler, Benson Boiler and Velox Boiler.

Steam Turbines: Introduction, Types of Steam Turbine, Working Principle of Steam Turbine Uses and Advantages of Steam Turbine.

### **Unit 7: I.C. Engines**

I.C. Engine Cycle: Otto, Diesel; Working Principle: Two Stroke Petrol and Diesel, Four Stroke Petrol and Diesel.

### **Unit 8: Transmission and Lubrication**

Transmission: Belt Drive, Rope Drive, Velocity Ratio, Tension Ratio, Effect of Centrifugal Tension; Application of these Drives.

Lubrication: Object of Lubrication, Different Methods of Lubrication, Properties of Lubricants.

### **Suggested Readings:**

1. Thermodynamics & Heat Power Engineering, Mathur & Mehta, Jain Brothers.
2. Thermal Engineering, P.L. Ballaney, Khanna Publishers.
3. A Text Book of Hydraulics, Khurmi, S. Chand.
4. A Text Book of Hydraulic Machines, Khurmi, S. Chand.
5. Strength of Materials, G.H.Ryder, Macmillan, India.
6. Strength of Materials: A Rudimentary Approach, M.A. Jayaram, Sapna Book House.
7. Elements of Heat Engines: Pande & Shah, Charotar Publishing House.

### **Note:**

1. Eight questions are to be set. Students will have to attempt five questions in all.
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**SYLLABUS**  
**DIPLOMA IN CHEMICAL ENGINEERING**  
**SEMESTER – II**

**BASIC ELECTRICAL ENGINEERING**

**Sub. Code:**

**Credits: 02**

**Total Marks: 100**

**Minimum Pass Marks: 40%**

**Internal Assessment: 40 Marks**

**University Examination: 60 Marks**

**BLOCK I**

**Unit 1: DC Circuits**

Concept of Electricity; Various Applications of Electricity; Advantages of Electricity over other Types of Energy; Basic Terms: Voltage, Current, Potential Difference, Power; Energy and their Units. Ohm's Law and its Practical Applications; Concepts of Resistance, Conductance, Resistivity and their Units. Effect of Temperature on Resistance; Temperature Coefficient of Resistance. Series and Parallel Combination of Resistors; Wattage Consideration; Simple Problems. Kirchhoff's Current Law and Kirchhoff's Voltage Law and their Applications to Simple Circuits. Conversion of Circuits from Star to Delta and Delta to Star.

**Unit 2: DC Circuits Theorems**

Thevenin's Theorem; Norton's Theorem; Super Position Theorem; Maximum Power Transfer Theorem, Application of Network Theorem in solving D.C Circuit Problems. Constant Voltage and Constant Current Sources: A) Concept of Constant Voltage Source, Symbol and Graphical Representation, Characteristics of Ideal and Practical Sources, B) Concept of Constant Current Sources, Symbol, Characteristics and Graphical Representation of Ideal and Practical Current Sources.

**Unit 3: Electro Magnetic Induction**

- A) Concepts of Magnetic Field Produced by Flow of Current; Magnetic Circuit; Concept of Magneto-Motive Force (MMF); Flux; Reluctance; Permeability; Analogy between Electric and Magnetic Circuit.
- B) Faraday's Law and Rules of Electro-Magnetic Induction; Principles of Self and Mutual Induction; Self and Mutually Induced E.M.F; Simple Numerical Problems.
- C) Concept of Current Growth; Decay and Time Constant in RL and RC Circuit.
- D) Energy Stored in an Inductor; Series and Parallel Combination of Inductors.

**Unit 4: Batteries**

Basic Idea about Primary and Secondary Cells; Construction; Working and Applications of Lead-Acid Battery and Nickel-Cadmium Cells; Silver-Oxide Cells; Charging Methods used for Lead-Acid Battery (Accumulator); Care and Maintenance of Lead-Acid Battery; Series and Parallel Connections of Batteries; General Idea of Solar Cells; Solar Panels and their Applications

## **BLOCK II**

### **Unit 5: AC Fundamentals**

Concept of Alternating Voltage and Current; Difference between A.C and D.C; Concept of Cycle, Frequency, Time Period, Amplitude, Instantaneous Value, Average Value, R.M.S. Value, Maximum Value, Form Factor and Peak Factor; Representation of Sinusoidal Quantities by Phasor Diagrams; Equation of Sinusoidal Wave Form (with Derivation); Effect of Alternating Voltage Applied to a Pure Resistance, Pure Inductance and Pure Capacitance.

### **Unit 6: AC Circuits**

Inductive Reactance and Capacitive Reactance; Alternating Voltage Applied to Resistance and Inductance in Series; Alternating Voltage Applied to Resistance and Capacitance in Series; Impedance Triangle and Phase Angle; Solutions and Phasor Diagrams for Simple RLC Circuits (Series and Parallel); Introduction to Series and Parallel Resonance and its Conditions; Power in Pure Resistance, Inductance and Capacitance, Power in Combined RLC Circuits; Power Factor; Active and Reactive Power and their Significance; Importance of Power Factor; J-Notation and its Application in Solving a Series and Parallel AC Circuits; Definition of Conductance, Susceptance and Admittance

### **Unit 7: Various Types of Power Plants**

Brief Explanation of Principle of Power Generation in Thermal, Hydro and Nuclear Power Stations and their Comparative Study; Elementary Block Diagram of above Mentioned Power Stations.

### **Suggested Readings:**

1. Electrical Technology, Vol. I, B.L. Theraja, S. Chand & Company Ltd.
2. Electrical Engineering, V.K. Mehta, S. Chand & Company Ltd.
3. Electrical Engineering,, Nitin Saxena, Laxmi Publisher.

### **Note:**

1. Eight questions are to be set. Students will have to attempt five questions in all.
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**SYLLABUS**  
**DIPLOMA IN CHEMICAL ENGINEERING**  
**SEMESTER – II**

**BASIC ELECTRONICS**

**Sub. Code:**

**Credits: 02**

**Total Marks: 100**

**Minimum Pass Marks: 40%**

**Internal Assessment: 40 Marks**

**University Examination: 60 Marks**

**BLOCK I**

**Unit 1: Semiconductor Physics**

Review of Basic Atomic Structure and Energy Levels; Concept of Insulators; Conductors and Semi Conductors; Atomic Structure of Ge and Si; Covalent Bonds. Concept of Intrinsic and Extrinsic Semi Conductor; P and N Impurities; Doping of Impurity. P and N Type Semiconductors and their Conductivity; Effect of Temperature on Conductivity of Intrinsic Semi Conductor. Energy Level Diagram of Conductors; Insulators and Semi Conductors; Minority and Majority Carriers.

**Unit 2: Semi Conductor Diode**

PN Junction Diode; Mechanism of Current Flow in PN Junction; Drift and Diffusion Current; Depletion Layer; Forward and Reverse Biased PN Junction; Potential Barrier; Concept of Junction Capacitance in Forward and Reverse Bias Condition. V-I Characteristics; Static and Dynamic Resistance and their Calculation from Diode Characteristics. Diode as Half Wave, Full Wave and Bridge Rectifier; PIV, Rectification Efficiencies and Ripple Factor Calculations; Shunt Capacitor Filter, Series Inductor Filter, LC Filter and  $\pi$  Filter. Types of Diodes; Characteristics and Applications of Zenor Diodes; Zenor and Avalanche Breakdown.

**Unit 3: Introduction to Bipolar Transistor**

Concept of Bipolar Transistor, Structure, PNP and NPN Transistor, their Symbols and Mechanism of Current Flow; Current Relations in Transistor; Concept of Leakage Current; CB, CE, CC Configuration of the Transistor; Input and Output Characteristics in CB and CE Configurations; Input and Output Dynamic Resistance in CB and CE Configurations; Current Amplification Factors. Comparison of CB CE and CC Configurations; Transistors as an Amplifier in CE Configurations; D.C Load Line and Calculation of Current Gain, Voltage Gain using D.C Load Line.

**BLOCK II**

**Unit 4: Transistor Biasing Circuits**

Concept of Transistor Biasing and Selection of Operating Point; Need for Stabilization of Operating Point; Different Types of Biasing Circuits.

### **Unit 5: Single Stage Transistor Amplifier**

Single Stage Transistor Amplifier Circuit; A.C Load Line and its use in Calculation of Currents and Voltage Gain of a Single Stage Amplifier Circuit; Explanation of Phase Reversal of Output Voltage with respect to Input Voltage; H- Parameters and their Significance; Calculation of Current Gain; Voltage Gain; Input Impedance and Output Impedance using h-Parameter.

### **Unit 6: Field effect Transistors**

Construction, Operation and Characteristics of FET and Its Application; Construction, Operation and Characteristics of MOSFET in Depletion and Enhancement Modes and its Applications; C MOS: Advantages and Applications; Comparison of JFET, MOSFET and BJT; FET Amplifier Circuit and its Working Principle. (No Analysis).

### **Suggested Readings:**

1. Basic Electronics and Linear Circuit, NN Bhargava and Kulshreshta, Tata McGraw Hill.
2. Principles of Electrical and Electronics Engineering, VK Mehta; S Chand and Co.
3. Electronic Components and Materials, SM Dhir, Tata McGraw Hill.
4. Electronics Devices and Circuits, Millman and Halkias; McGraw Hill.
5. Principles of Electronics, Albert Paul Malvino; Tata McGraw Hill.
6. Electronics Devices and Circuits-I, Naresh Gupta, Jyotesh Malhotra and Harish C Saini, Eagle Prakashan.
7. Electronics Devices and Circuits by Rama Reddy, Narosa Publishing House Pvt. Ltd.

### **Note:**

1. Eight questions are to be set, at least one question from each unit. Students will have to attempt five questions in all.
2. Use of non-programmable scientific calculator is allowed in Examination Hall.

**SYLLABUS**  
**DIPLOMA IN CHEMICAL ENGINEERING**  
**SEMESTER – II**

**ENGINEERING DRAWING**

**Sub. Code:**

**Credits: 02**

**Total Marks: 100**

**Minimum Pass Marks: 40%**

**Internal Assessment: 40 Marks**

**University Examination: 60 Marks**

**BLOCK I**

**Unit 1: Introduction**

Application of Engineering Drawing in Engineering; Lettering and Dimensioning; Construction of Geometrical Figures like Pentagon; Hexagon etc.

**Unit 2: Scales**

Plain Scale; Diagonal Scale; Venier Scale.

**Unit 3: Projections**

First Angle and Third Angle Projections; Simple Projection of Points; Lines and Planes; Orthographic Projection of Simple Solids in Simple Positions.

**Unit 4: Sections**

Importance and Salient Features; Drawing of Full Section; Half Section; Partial or Broken Out Sections; Offset Sections; Revolved Sections and Removed Sections; Drawing of Different Conventions for Materials Intersection.

**Unit 5: Isometric Projections**

Principle of Isometric Projection; Isometric Projection using Box and Offset Method

**Unit 6: Development of Surfaces**

Development of Surfaces of Regular Solids like Pyramids and Prisms.

**Suggested Readings:**

1. Elementary Engineering Drawing, Bhatt N.D, Charoathar Publisher
2. A Text Book of Practical Geometry on Geometrical Drawing, Laxmi Narayan V & Vaish W, Pearson Education.
3. Design for manufacture, Cordett J, Dooner M, Meleka J and Pyn C, Addison Wesley.
4. The Engineering Design Process, Hawkes B and Abinett R, Longman.

**Note:**

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**SYLLABUS**  
**DIPLOMA IN CHEMICAL ENGINEERING**  
**SEMESTER – III**

**THERMODYNAMICS**

**Sub. Code:**

**Credits: 02**

**Total Marks: 100**

**Minimum Pass Marks: 40%**

**Internal Assessment: 40 Marks**

**University Examination: 60 Marks**

**BLOCK - I**

**UNIT – I : Combustion of Fuel**

Introduction, Mass fraction and Mole Fraction, Symbols for Elements and Compounds, Combustion Equations of Gaseous Fuels, Theoretical or Minimum Mass of Air Required for Complete Combustion, Theoretical or Minimum Volume of Air required for Complete Combustion, Excess Air Supplied, Air Fuel ratio, Analysis of products of combustion, Combustion Equations, Volumetric analysis of products, Conversion of volumetric analysis to gravimetric analysis, Volume Fraction, Conversion of volumetric Analysis into Mass Analysis or Gravimetric Analysis, Conversion of Mass Analysis into Volumetric Analysis, Mass of Carbon in Fuel Gases, The analysis of Fuel Gas, The Orsat Apparatus.

**UNIT –II : Entropy**

Introduction, Entropy as a property, The Second Law, Analysis for Entropy, Clausius Inequality, Change of entropy in an irreversible process, Change of Entropy for Ideal Gas and Pure Substance, Change of Entropy of a perfect gas during Various Thermodynamics Processes, Change of Entropy during Constant Process (or Isobaric Process), Change of Entropy during Constant Temperature Process (or Isothermal process), Change of Entropy during Reversible Adiabatic Process (or Isentropic Process), Change of Entropy during Plytropic Process ( $p_{rn} = \text{Constant}$ ).

**UNIT – III : Air Compressor**

Introduction, Uses of Compressed air for industries, Types of Air Compressors, Capacity Control of Compressor, Types of compressor valves, Work done by Reciprocating Air Compressor with Clearance Volume, Effect of Clearance on volumetric efficiency, Condition for maximum efficiency in two stage compression with intercooling.

**UNIT – IV : IC Engine**

Introduction, Classification of I.C. Engines, Fuel Supply System for S.I. and C.I. Engine, Ignition Systems of Petrol Engines, Fuel Injection system for Diesel Engines, Cooling Systems for I.C. Engines, Lubrication System for I.C. Engines, Governing of internal combustion engines, Main Components of I.C. Engines, Reciprocating Internal Combustion Engines, Four-Stroke cycle, Two-stroke cycle.



### **UNIT – V : IC Engine Testing & Performance**

Indicated Power, Measurement of friction power, Indicated mean Effective Pressure, Measurement of fuel consumption, Energy balance of an I.C. Engine, Determination of mechanical, Thermal and Relative efficiency.

### **UNIT – VI : Steam Process**

Introduction, Thermodynamics Processes of Vapour, Enthalpy – Entropy or H-S Chart or Mollier Diagram, Measurement of dryness-fraction of steam, Bucket or Barrel Calorimeter, BOILER, Introduction, Classification of Boilers, Boiler Mountings and Accessories, Equivalent Evaporation, Boiler Efficiency, Heat Losses in a Boiler, Heat Balance Sheet, Boiler Draught.

### **UNIT – VII : Vapour Power Cycle**

Introduction, The Carnot cycle, The ideal Rankine Cycle, Factors affecting the performance of Rankine cycle.

### **UNIT – VIII : Air Standard Cycle**

Introduction, Otto Cycle, Diesel Cycle, Dual Combustion Cycle, Comparison of Otto, Diesel Dual Cycle, Air and Fuel-vapour mixtures Concept of air fuel Cycle.

### **Suggested Readings:**

1. Thermodynamics by Cengel Yunus

#### **Note:**

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**SYLLABUS  
DIPLOMA IN CHEMICAL ENGINEERING  
SEMESTER – III**

**TRANSPORT PROCESSES -I**

**Sub. Code:**

**Credits: 02**

**Total Marks: 100**

**Minimum Pass Marks: 40%**

**Internal Assessment: 40 Marks**

**University Examination: 60 Marks**

**BLOCK - I**

**UNIT – I : INTRODUCTION TO ENGINEERING PRINCIPLES & UNITS**

Classification of Unit Operations and Transport Processes, SI System of Basic Units Used in This Text and Other Systems, Methods of Expressing Temperatures and Compositions, Gas Laws and Vapor Pressure, Conservation of Mass and Material Balances, Energy and Heat Units, Conservation of Energy and Heat Balances, Graphical, Numerical, and Mathematical Methods.

**UNIT–II: PRINCIPLES OF MOMENTUM TRANSFER & OVERALL BALANCES**

Introduction, Fluid Statics, General Molecular Transport Equation for Momentum, Heat and Mass Transfer, Viscosity of Fluids, Types of Fluid Flow and Reynolds Number, Overall Mass Balance and Continuity Equation, Overall Energy Balance, Overall Momentum Balance, Shell Momentum Balance and Velocity Profile in Laminar Flow, Design Equations for Laminar and Turbulent Flow in Pipes, Compressible Flow of Gases.

**UNIT – III : PRINCIPLES OF MOMENTUM TRANSFER & APPLICATIONS**

Flow Past Immersed Objects and Packed and Fluidized Beds, Measurement of Flow of Fluids, Pumps and Gas- Moving Equipment, Agitation and Mixing of Fluids and Power Requirements, Non-Newtonian Fluids, Differential Equations of Continuity, Differential Equations of Momentum Transfer of Motion, Use of Differential Equations of Continuity and Motion, Other Methods for Solution of Differential Equations of Motion, Boundary- Layer Flow and Turbulence, Dimensional Analysis in momentum Transfer.

**UNIT – IV : PRINCIPLES OF STEADY-STATE HEAT TRANSFER**

Introduction and Mechanisms of Heat Transfer, Conduction Through Solids in Series, Steady-State Conduction and Shape Factors, Forced Convection Heat Transfer Inside Pipes, Heat Transfer Outside Various Geometries in Forced Convection, Natural Convection Heat Transfer, Boiling and Condensation, Heat Exchangers, Introduction to Radiation Heat Transfer, Advanced Radiation Heat Transfer Principles, Heat Transfer of Non- Newtonian

Fluids, Special Heat-Transfer Coefficients, Dimensional Analysis in Heat Transfer, Numerical Methods for Steady-State Conduction in Two Dimensions.

**Suggested Readings:**

1. Transport Processes -I by Christie John Geankoplis

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**SYLLABUS**  
**DIPLOMA IN CHEMICAL ENGINEERING**  
**SEMESTER – III**

**NON CONVENTIONAL ENERGY ENGINEERING**

**Sub. Code:**

**Credits: 02**

**Total Marks: 100**

**Minimum Pass Marks: 40%**

**Internal Assessment: 40 Marks**

**University Examination: 60 Marks**

**BLOCK - I : SOURCES OF ENERGY**

**UNIT – I : Solar Energy**

Introduction, The Solar Energy Supply, History of Direct Solar Energy Utilization, Technologies Based on Capture of Heat from Sunlight, Technologies for Converting Solar Energy to Electricity

**UNIT – II : Wind Energy**

Introduction, How does the wind Blow? , Using the Wind, Power in the Wind, Design of Windmills, Wind Turbine Sizes, Future of Wind Power, Research and Development, Wind Sites and Properties, Storage, The Indian Scenario.

**UNIT – III : Wave Energy**

Introduction, Wave Energy Generation, Wave Energy Conversion Devices, Advantages and Disadvantages of Wave Energy, Wave Energy and India

**UNIT – IV : Tidal Energy**

Introduction, Main Types of Tidal Power Generation Systems, Potential of Tidal Power and Present Status of its Utilization

**UNIT – V : GEOTHERMAL ENERGY**

Introduction, History and Present Extent of Utilization, Energy Extraction, Geothermal Fields in India, Major Limitations

**UNIT – VI : Small Hydro**

Introduction : What is Small Hydro? , A Brief history, Potential of Small Hydro in India, Engineering Consideration, Incentives for Small Hydro, Technologies Available, The Thrust is Great, Environmental Impacts

## **BLOCK - II : ENVIRONMENTAL IMPACT**

### **UNIT – VII : Environmental Impact of Renewable Energy Sources**

Introduction, Are Non - Conventional Energy Sources Environmentally Benign? , Biomass Energy – Centralized (Large Scale) Systems, Biomass Energy – Dispersed Systems, Ocean Thermal Energy.

#### **Suggested Readings:**

1. Non Conventional energy by Christie John Geankoplis
2. Environmental Impact by R Karthigarani J Sacrates

#### **Note:**

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**SYLLABUS**  
**DIPLOMA IN CHEMICAL ENGINEERING**  
**SEMESTER – III**

**ELECTRICAL MACHINES**

**Sub. Code:**

**Credits: 02**

**Total Marks: 100**

**Minimum Pass Marks: 40%**

**Internal Assessment: 40 Marks**

**University Examination: 60 Marks**

**BLOCK - I**

**UNIT – I : Introduction**

Basic concept of Electrical Engineering; Resistance; Inductance; Capacitance; Resistance connected in series and Parallel; Capacitance connected in series and parallel; Concept of AC/DC currents and AC/DC Voltages; EMF; Potential difference, Work, Power and Energy.

**UNIT – II :DC Networks**

Kirchhoff's Laws; Node voltage and Mesh current Methods; Delta – Star and Star - Delta Conversion; Superposition principle; Thevenin's and Norton's Theorems

**UNIT – III : Transformer**

Construction and principle of X'Mers; EMF equation; Ideal X'Mer; Shell type & Core type X'Mer; Phasor Diagrams ; Equivalent Circuits; Regulation and Efficiency of X'Mer; Capacity of X'Mer, and Losses; Introduction to Auto X'Mer

**UNIT – IV : DC Machines**

Construction and Principle of DC generation and DC Motor; Back emf of DC Motor; Types of DC Motor; Reversal of Direction of Rotation of DC Motor; Starting of DC Motor; Uses of DC Motor; Losses in DC Machine.

**UNIT – V : Alternator**

Construction and Working principle of Alternator; Application of Alternators.

**UNIT – VI : Synchronous Motors**

Principle of Operation; Application of Synchronous Motors; Comparison between Synchronous Motor and Induction Motors

**Suggested Readings:**

1. Electrical Machines by Smarajit Ghosh

**Note:**

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