BANGLADESH TECHNICAL EDUCATION BOARD
Agargoan, Dhaka-1207.

4-YEAR DIPLOMA-IN-ENGINEERING PROGRAM
SYLLABUS (PROBIDHAN-2016)

CHEMICAL TECHNOLOGY

TECHNOLOGY CODE: **663**

3rd SEMESTER

DIPLOMA IN ENGINEERING
PROBIDHAN-2016

CHEMICAL TECHNOLOGY (663)

3rd SEMESTER

Sl. No	Subject Code	Name of the subject	T	P	C	Marks				Total
						Theory		Practical		
						Cont. assess	Final exam	Cont. assess	Final exam	
1	65931	Mathematics -3	3	3	4	60	90	50	0	200
2	65922	Physics-2	3	3	4	60	90	25	25	200
3	65812	Physical Education & Life Skill Development	0	3	1	0	0	25	25	50
4	66822	Electronic Engineering Fundamentals	2	3	3	40	60	25	25	150
5	66712	Electrical Engineering Fundamentals	3	3	4	60	90	25	25	200
6	66331	Chemical Engineering Operation-1	2	3	3	40	60	25	25	150
7	66332	Chemical Engineering Materials	2	3	3	40	60	25	25	150
Total			**15**	**21**	**22**	**300**	**450**	**200**	**150**	**1100**

65931 MATHEMATICS -3

T	P	C
3	3	4

AIMS

- To enable to calculate the areas of regular polygons, hexagons, octagon, hydraulic mean depth (HMD) of a channel, area occupied by water of circular culvert. Excavation work.
- To provide the ability to calculate volume of regular solids like pyramid frustum of pyramid, prismoid, wedge and area of curved surfaces.
- To enable to use the knowledge of gradient of a straight line in finding speed, acceleration etc.
- To enable to use the knowledge of conic in finding the girder of a railway bridge, cable of a suspension bridge and maximum height of an arch.
- To make understand the basic concept and techniques of composition and resolution of vectors and computing the resultant of vectors.

- **SHORT DESCRIPTION**

Menstruation : Area of rectangles, squares, triangles, quadrilaterals, parallelograms, rhombus, trapezium, circle, sector, segment; Volume of rectangular solids, prism, parallelepiped, pyramids, cones, spheres, frustum of pyramid and cone; Area of curved surface of prism, Cylinder cone, pyramid and frustum of cone.

Co-ordinate Geometry: Co-ordinates of a point, locus and its equation, straight lines, circles and conic.

Vector: Addition and subtraction, dot and cross product.

DETAIL DESCRIPTION

MENSURATION:

1 Apply the concept of area of triangle.

1.1 Find the area of triangle in the form,

i) $A=\frac{\sqrt{3}}{4}a^2$, a = length of a side of equilateral triangle.

ii) $A=\frac{c}{4}\sqrt{4a^2-c^2}$, where a = length of equal sides, c = third side.

iii) $A=\sqrt{s\ (s-a)(s-b)(s-c)}$, where a, b, c = length of the sides of a triangle and 2s is the perimeter of the triangle.

1.2 Use formula in 1.1 to solve problems.

2 Apply the concept of finding areas of quadrilateral & Parallelogram & finding areas of rhombus & trapezium.

2.1 Define quadrilateral & Parallelogram.
2.2 Find the areas of quadrilateral when off sets are given.
2.3 Find the areas of a parallelogram.
2.4 Solve problems using above formulae.
2.5 Define rhombus & trapezium.
2.6 Find the areas of rhombus when the diagonals are given.
2.7 Find the areas of trapezium in terms of its parallel sides and the perpendicular distance between them.
2.8 Solve problems related to rhombus & trapezium.

3 Apply the concept of finding areas of regular polygon.

3.1 Define a regular polygon.
3.2 Find the area of a regular polygon of n sides, when
  i) The length of one side and the radius of inscribed circle are given.
  ii) The length of one side and the radius of circumscribed circle are given.
3.3 Find the area of a regular.
a) Hexagon
  b) Octagon when length of side is given.
3.4 Solve problems of the followings types:

A hexagonal polygon 6 m length of each side has a 20 cm width road surrounded the polygon. Find the area of the road.

4 Understand areas of circle, sector and segment.

4.1 Define circle, circumference, sector and segment.
4.2 Find the circumference and area of a circle when its radius is given.
4.3 Find the area of sector and segment of a circle.
4.4 Solve problems related to the above formulae.

5 Apply the concept of volume of a rectangular solid.

5.1 Define rectangular solid and a cube.
5.2 Find geometrically the volume of a rectangular solid when its length, breadth and height are given.
5.3 Find the volume and diagonal of a cube when side is given.
5.4 Solve problems with the help of 6.2 & 6.3.

6 Apply the concept of surface area, volume of a prism, parallelepiped and cylinder.

6.1 Define a prism, parallelepiped and a cylinder.
6.2 Explain the formulae for areas of curved surfaces of prism, parallelepiped and cylinder.
6.3 Explain the formulae for volume of prism, parallelepiped and cylinder when base and height are given.
6.4 Solve problems related to 7.2, 7.3.

7 Apply the concept of the surface area, volume of pyramid, cone and sphere.

7.1 Define pyramid, cone and sphere.
7.2 Explain the formula for areas of curved surfaces of pyramid, cone and sphere.
7.3 Explain the formula for volumes of pyramid, cone and sphere.
7.4 Solve problems related to 8.2, 8.3.

CO-ORDINATE GEOMETRY

8 Apply the concept of co-ordinates to find lengths and areas.

8.1 Explain the co-ordinates of a point.
8.2 State different types of co-ordinates of a point.
8.3 Find the distance between two points (x_1, y_1) and (x_2, y_2).
8.4 Find the co-ordinates of a point which divides the straight line joining two points in certain ratio.
8.5 Find the area of a triangle whose vertices are given.
8.6 Solve problems related to co-ordinates of points and distance formula.

9 Apply the concept of locus & the equation of straight lines in calculating various Parameter.

9.1 Define locus of a point.
9.2 Find the locus of a point.
9.3 Solve problems for finding locus of a point under certain conditions.
9.4 Describe the Equation x=a and y=b and slope of a straight line.
9.5 Find the slope of a straight line passing through two point $(x_1, y_1,)$ and (x_2, y_2).
9.6 Find the equation of straight lines:
(i) Point slope form.
(ii) Slope Intercept form.
(iii) Two points form.
(iv) Intercept form.
(v) Perpendicular form.
9.7 Find the point of intersection of two given straight lines.
9.8 Find the angle between two given straight lines.
9.9 Find the condition of parallelism and perpendicularity of two given straight lines.
9.10 Find the distances of a point from a line.

10 Apply the equations of circle, tangent and normal in solving problems.

10.1 Define circle, center and radius.

10.2 Find the equation of a circle in the form:

(i) $x^2 + y^2 = a^2$

(ii) $(x - h)^2 + (y - k)^2 = a^2$

(iii) $x^2 + y^2 + 2gx + 2fy + c = 0$

10.3 Find the equation of a circle described on the line joining (x_1, y_1) and (x_2, y_2).

10.4 Define tangent and normal.

10.5 Find the condition that a straight line may touch a circle.

10.6 Find the equations of tangent and normal to a circle at any point.

10.7 Solve the problems related to equations of circle, tangent and normal.

11 Understand conic or conic sections.

11.1 Define conic, focus, Directorx and Eccentricity.

11.2 Find the equations of parabola, ellipse and hyperbola.

11.3 Solve problems related to parabola, ellipse and hyperbola.

VECTOR :

12 Apply the theorems of vector algebra.

12.1 Define scalar and vector.

12.2 Explain null vector, free vector, like vector, equal vector, collinear vector, unit vector, position vector, addition and subtraction of vectors, linear combination, direction cosines and direction ratios, dependent and independent vectors, scalar fields and vector field.

12.3 Prove the laws of vector algebra.

12.4 Resolve a vector in space along three mutually perpendicular directions

12.5 Solve problems involving addition and subtraction of vectors.

13 Apply the concept of dot product and cross product of vectors.

13.1 Define dot product and cross product of vectors.

13.2 Interpret dot product and cross product of vector geometrically.

13.3 Deduce the condition of parallelism and perpendicularity of two vectors.

13.4 Prove the distributive law of dot product and cross product of vector.

13.5 Explain the scalar triple product and vector triple product.

13.6 Solve problems involving dot product and cross product.

Reference

SL No	Athour	Title	Publication
01	G. V. Kumbhojkar	Companian to basic Maths	Phadke Prakashan
02	Murary R Spigel	Vector & Tensor Analysis	Schaum's Outline Series
03	Md. Abu Yousuf	Vector & Tensor Analysis	Mamun Brothers
04	Rahman & Bhattacharjee	Co-ordinate Geometry & Vector Analysis	H.L. Bhattacharjee
05	Md. Nurul Islam	Higher Mathematics	Akkhar Patra Prakashani

65922	PHYSICS-2	T	P	C
		3	3	4

OBJECTIVES

- To develop a foundation in scientific principles and processes for the understanding and application of technology.
- To develop an understanding of fundamental scientific concepts through investigation and experimentation.
- To provide a common base for further studies in technology and science.
- To develop the basic knowledge of modern physics.

SHORT DESCRIPTION

Thermometry and Heat Capacity; Expansion of materials (effect of heat); Heat transfer; Humidity; Nature of heat and Thermodynamics; Photometry; Reflection of light; Refraction of light; Electron , photon and Radio activity; Theory of Relativity.

DETAIL DESCRIPTION

THEORY

1. THERMOMETRY AND HEAT CAPACITY

1.1 Define heat and temperature.
1.2 Mention the units of measurement of heat and temperature.
1.3 Distinguish between heat and temperature.
1.4 Identify the range of the Celsius scale determined by the boiling point and melting point of water
1.5 State the construction and graduation of a mercury thermometer.
1.6 Define specific heat capacity, thermal capacity and water equivalent with their units.
1.7 Prove the total heat gained by an object is equal to the sum of the heat lost by all the surrounding objects.
1.8 Explain the principle of calorimetry.
1.9 Define various kinds of specific latent heat.
1.10 Determine the latent heat of fusion of ice and latent heat of vaporization of water.
1.11 Determine the specific heat of a solid by calorimeter.

2. EFFECT OF HEAT ON DIMENSION OF MATERIALS

2.1 Show that different materials change in size at different amounts with the same heat source.
2.2 Explain the meaning of differential expansion in bimetallic strip, thermostats, compensated pendulum etc.
2.3 Explain the methods of overcoming problems caused by the expansion of materials in buildings, machinery, railway lines and bridges.
2.4 Mention the units co-efficient of linear, superficial and cubical expansion of solids.
2.5 Define the co-efficient of linear, superficial and cubical expansion of solids.
2.6 Relation between the co-efficient of linear, superficial and cubical expansion of solids.
2.7 Define real and apparent expansion of liquid.

2.8 Relation between the real and apparent expansion of liquid.

3. HEAT TRANSFER

3.1 Identify the phenomena of heat transferring from hot bodies to cold bodies.
3.2 Explain the methods of heat transfer by conduction, convection and radiation with examples of each type of transfer.
3.3 Define thermal conductivity (K) and Co-efficient of thermal conductivity.
3.4 Find the unit and dimension of Co-efficient of thermal conductivity.
3.5 List the factors which determine the quantity of heat (Q) flowing through a material.
3.6 Show that the quantity of heat flowing through a material can be found from

$$Q = \frac{KA\,(\theta_H - \theta_C)t}{d}$$

3.7 State Stefan-Boltzman Law and wien's law.
3.8 State Newton's law of cooling.
3.9 Explain Green house effect.

4. HUMIDITY

4.1 Define Standard Temperature and Pressure.
4.2 Define Humidity, Absolute Humidity, Relative Humidity and Dewpoint.
4.3 Relation between vapour pressure and air pressure.
4.4 Determine Humidity by wet and dry bulb hygrometer.
4.5 Explain few phenomena related to hygrometry.

5. NATURE OF HEAT AND THERMODYNAMICS

5.1 Describe the caloric theory and kinetic theory of heat.
5.2 Explain the mechanical equivalent of heat.
5.3 State and Explain the first law of thermodynamics .
5.4 Explain Isothermal and adiabatic change.
5.5 Explain Specific heat of a gas, Molar specific heat or molar heat capacity.
5.6 Relate between pressure and volume of a gas in adiabatic Change i, e;PV^{γ}=const.
5.7 State and Explain Reversible process and irreversible process.
5.8 State & explain 2^{nd} law of thermodynamics
5.9 Entropy: Definition, unit and significant.
5.10 Explain Change of entropy in a reversible and irreversible process.
5.11 Give an example of increase of entropy in irreversible process.

6. PHOTOMETRY

6.1 Define light, medium (transparent, translucent, opaque), luminous & non-luminous bodies, parallel, convergent & divergent of rays.
6.2 Show the travel of light in straight line.
6.3 Define photometry, luminous intensity, luminous flux, brightness and illuminating power.
6.4 Mention relation between luminous intensity & illuminating power.
6.5 Explain inverse square law of light.
6.6 Describe the practical uses of light waves in engineering.

7. REFLECTION OF LIGHT

7.1 Define mirror (plane & spherical), image (real & virtual) and magnification of images.
7.2 Describe the reflection of light.
7.3 State the laws of reflection of light.
7.4 Express the verification of laws of reflection.
7.5 Define pole, principal axis, center of curvature, radius of curvature, principal focus in case of concave & convex mirrors.
7.6 Find the relation between focal length & radius of curvature of a concave & convex mirror.
7.7 Express the general equation of concave and convex mirror.

8. REFRACTION OF LIGHT

8.1 Define refraction of light Give examples of refraction of light
8.2 State the laws of refraction and Express the verification of laws of refraction
8.3 Define absolute and relative refractive index and Relate absolute and relative refractive index
8.4 Explain the meaning of total internal reflection and critical angle and Relate total internal reflection and critical angle.
8.5 Give examples of total internal reflection.
8.6 Describe refraction of light through a prism.
8.7 Express the deduction of the relation between refractive index, minimum deviation and angle of the prism.
8.8 Define lens and mention the kinds of lens.
8.9 Identify and List uses of lens.
8.10 Express the deduction of the general equation of lens (Concave & convex).

9. ELECTRON, PHOTON AND RADIO-ACTIVITY

9.1 Describe Electrical conductivity of gases.
9.2 Describe Discharge tube.
9.3 Cathode ray : Definition and its properties
9.4 X-ray : Definition, properties & uses
9.5 Discuss Photo electric effect .
9.6 Derive Einstein's photo electric equation
9.7 Define and explain radio-activity.
9.8 Describe radio-active decay law.
9.9 Define half-life and mean-life of radio-active atoms.
9.10 Define nuclear fission and fusion.

10. THEORY OF RELATIVITY

10.1 Define Space, time and Mass.
10.2 Define rest mass.
10.3 Express the theory of relativity.
10.4 Explain special theory of relativity and its fundamental postulate.
10.5 Mention different Kinds of theory of relativity.
10.6 The Relativity of Length - Length contraction.
10.7 The Relativity of Time – Time dilation.
10.8 Deduce Einstein's mass -energy relation

PRACTICAL

1. Compare the operation of common thermometers.
2. Determine the co-efficient of linear expansion of a solid by Pullinger's apparatus.
3. Measure the specific heat capacity of various substances.(Brass, steel).
4. Determine the latent heat of fusion of ice.
5. Determine the water equivalent by calorimeter.
6. Compare the luminous intensity of two different light sources.
7. Verify the laws of reflection.
8. Find out the focal length of a concave mirror.
9. Determine the refractive index of a glass Slab.
10. Determine the angle of Minimum deviation and refractive index of a glass prism by using I-D graph.

REFERENCE BOOKS:

1. Higher Secondary Physics – Second Part - by Dr. Shahjahan Tapan
2. A Text Book of Heat and Thermodynamics - by N Subrahmanyam and Brij Lal
3. A Text Book of Optics - by N Subrahmanyam and Brij Lal
4. Higher Secondary Physics -Second Part - by Prof. Golam Hossain Pramanik
5. Higher Secondary Physics -Second Part - by Ishak Nurfungnabi
6. Thermodynamics - by K K Ramalingam

65812 PHYSICAL EDUCATION AND LIFE SKILL DEVELOPMENT T P C
0 3 1

OBJECTIVES

- To enhance body fitness.
- To make aware of First Aid Procedure.
- To acquaint with the Common games and sports.
- To develop Life Skill.

SHORT DESCRIPTION

Warm up; Yoga; Muscle developing with equipment; Meditation, First aid; sports science, Games & sports; Life skill development.

DETAIL DESCRIPTION

1. National Anthem and Assembly

1.1 Line and File.
1.2 Make assembly.
1.3 Recitation of national anthem.
1.4 National anthem in music.

2. Warm up

2.1 **General Warm-up :**
Spot running (Slow, Medium & Fast), Neck rotation, Hand rotation, Side twisting, Toe touching, Hip rotation, Ankle twisting, Sit up and Upper body bending (Front & Back).

2.2 **Squad Drill :**
Line, File, Attention, Stand at easy, Stand easy, Left turn, Right turn, About turn, Mark time, Quick march, Right wheel, Left wheel, Open order march & Closed order march.

2.3 **Specific warm up :**
Legs raising one by one, Leg raising in slanting position, Knee bending and nose touching, Heels raising, Toes touching (standing and laying position), Hand stretch breathing (Tadasana, Horizontal, Vertical).

2.4 Mass Physical Exercise
Hand raising, Side twisting, Front & back bending, Front curl, Straight arm curl two hand, Hands raising overhead and Push up.

3. Yoga

3.1 Dhyanasan : Shabasan, Padmasan, Gomukhasan, Sharbangasan, shashangasan Shirshasan
3.2 Shasthyasan : Halasan, Matshasan, Paban Muktasan, Ustrasan.
3.3 Prana and Pranayama: Nadisuddhi Pranayma, cooling pranayamas (sitali pranayama, Sitkari Pramayama, sadanta pranayama), Ujjayi pranayama,

4. Muscle Developing with equipment

4.1 Damball : Front curl, Hand sidewise stretching, Arms raising overhead.
4.2 Barball : Front press, Leg press, Rowing motion with leverage bar.
4.3 Rope climbing : Straight way climbing, Leg raising climbing.
4.4 Horizontal bar : Chinning the bar with front grip, Chinning the bar with wide back grip.
4.5 Jogging Machine : Slow, Medium, and Fast running.
4.6 A. B king pro (Rowing Machine): Sit up.
4.7 Sit up bench: Sit up.

5 **Meditation**

5.1 Define meditation.
5.2 Classification of Meditation.

5.3 Nadanusandhana (A-Kara chanting, U-Kara chanting, M-Kara chanting, AUM-kara chanting.
5.4 OM-Meditation.
5.5 Cyclic Meditation (Starting Prayer, Instant Relaxation Technique, Centring, Standing Asanas, Sitting Asanas, Quick Relaxation Technique).

6. **First Aid**
6.1 Define First Aid.
6.2 What do you mean by First Aider.
6.3 Discuss the responsibilities of a First Aider.
6.4 Different types of equipment of First Aid.
6.5 Muscle Cramp-Ice application (Remedy).
6.7 Dislocation-Ice application (Remedy).

7. Rules and Technique of games and sports
7.1 Kabadi.
7.2 Football.
7.3 Cricket.
7.4 Badminton.
7.5 Athletics.
7.6 Swimming.

8. Sports Science
8.1 Definition of Exercise physiology.
8.2 Function of muscles.
8.3 Concept of work, energy and power.
8.4 Effect of exercise on heart and circulatory system.
8.5 Motor components for physical fitness.
8.6 Definition of sports Biomechanics.
8.7 Definition of sports psychology.
8.8 Meaning of nutrition, Diet and Balanced diet.
8.9 Meaning of the terms –Test, measurement and Evaluation.

9. Show skill on conversation on day to day life
9.1 Today's Market price.
9.2 Festivals(religious festivals, National festivals).
9.3 Celebration of National days.
9.4 Aim in life.
9.5 Visited historical places/sites.

10. Human relation
10.1 Family relation.
10.2 Relation with nighbour.
10.3 Humanitarian Service.
10.4 Service for handicapped (intelligent, physical, social etc).
10.5 Service for orphan / Patient.

11 Vote of appreciation
11.1 About dress .
11.2 For good work.
11.3 For good result.
11.4 For good news.

12. Stress Management
12.1 Habit to be a man of humor.
12.2 Always brain should be cool.
12.3 Positive thinking.
12.4 Factors that determine our attitude.
12.5 The benefits of a positive attitude.
12.6 Steps to building a positive attitude.

13 Time Management

13.1 Determine essential time for a task.
13.2 Determine delay and unexpected time.
13.3 Determine time for daily activities .
13.4 Plan for daily activities.

14 Interview Technique

14.1 Mental preparation to face an interview.
14.2 Selection of dress for interview.
14.3 Introducing himself/herself to the interviewer .
14.4 Coping interview.

15 Team work

15.1 Organized a team.
15.2 Selection of team leader.
15.3 Distribution the task to the members.
15.4 Accepting opinion of team members.
15.5 Completion of task as a team.

16 Social work

16.1 Tree plantation.
16.2 Community service.
16.2.1 Rover Scout.
16.2.2 Sanitation.
16.2.3 Pure drinking water.
16.2.4 Social Culture.

Reference Book

Modern Yoga _Kany Lal Shah
Rules of games and sports_ Kazi Abdul Alim
Yoga _ Sobita Mallick
Iron Man_ Nilmoni Dass

66822	Electronics Engineering Fundamental	T	P	C
		2	3	3

OBJECTIVES

- To provide understanding soldering technique and color code.
- To provide understanding and skill on the basic concept of semiconductor and to identify physically a range of semiconductor diodes.
- To develop comprehensive knowledge and skill on special diodes and devices.
- To develop the abilities to construct different rectifier circuits.
- To provide understanding of the basic concept and principle of transistor and toidentify physically a range of transistor.
- To provide understanding and skill on oscillator.
- To provide the understanding skills on Multivibrator.

SHORT DESCRIPTION

Color code and soldering; Semiconductor; P-N junction diode; Special diodes and devices; Power supply; Transistor; Transistor amplifier; Oscillator, Multivibrator.

DETAIL DESCRIPTION

Theory:

1 Soldering and Color Code.

1.1 Define soldering.
1.2 List the materials needed in soldering.
1.3 Mention the properties of a good soldered joint.
1.4 Multi layered Printed circuit board.
1.5 Mention the function of resistor, capacitor and inductor in electronic circuits.
1.6 Describe the procedure of determining the value of Capacitor, & Resistor using numeric and color code.

2 Semiconductor

2.1 Define Conductor, Semiconductor and Insulator.
2.2 Describe Semiconductor with atomic structure.
2.3 Explain the energy band diagram of Conductor, Semiconductor and Insulator.
2.4 Classify Semiconductor.
2.5 Describe the formation of P-type & N-Type Semiconductor material.
2.6 Explain the majority & minority charge carrier of P-type & N-Type Semiconductor.

3 P-N Junction Diode

3.1 Define PN junction diode
3.2 Describe the formation of depletion layer in PN junction.
3.3 Mention the behavior of PN junction under forward and reverse bias.
3.4 Explain the forward & reverse current voltage (IV) characteristics of PN junction diode.
3.5 Describe the operation of Zener diode.
3.6 Describe the application of Zener diode in voltage stabilization.
3.7 Describe the construction operation and application of (i) varactor diode (ii) LED (iii) LCD (viii) photo diode (ix) Solar cell.
3.8 Describe the construction operation and application of (i) DIAC (ii) TRIAC and (iii) SCR.

4 DC power supplies.

4.1 Define (i) dc power supply (ii) Regulated and Unregulated Power Supply.
4.2 Describe the block diagram of a typical regulated dc power supply.
4.3 Explain the operation of Half wave, Full wave and Bridge rectifier.
4.4 Mention ripple factor of Half wave, Full wave and Bridge rectifier.
4.5 Explain the operation of different types filter circuits with wave shape.

5 Bipolar Junction Transistor (BJT)

5.1 Define Transistor.

5.2 Describe the construction PNP and NPN Transistor.
5.3 State the biasing rules of BJT.
5.4 Explain the mechanism of current flow of PNP and NPN Transistor.
5.5 Draw the three basic transistor configuration circuits (CB, CC, CE).
5.6 Describe the characteristics of transistor in CB, CE, CC configuration.
5.7 Describe current amplification factor α , β and γ.
5.8 Establish the relation among α , β and γ.
5.9 Solve problem related to I_E, I_C, I_B,α , β and γ.

6 Transistor biasing and load line.

6.1 Mention the needs for biasing of transistor
6.2 State the conditions for proper biasing of transistor.
6.3 Describe the methods of drawing load line of transistor.
6.4 Explain the Effect of the location of operating point on the output signal.
6.5 Describe the various methods of transistor biasing.

7 Transistor Amplifier

7.1 Define (i) Amplifier (ii) Amplification and (III) Gain
7.2 Mention the classification of Amplifier.
7.3 Describe the principle of operation of a single stage common emitter (CE) Amplifier.
7.4 Draw DC & AC equivalent circuits of the CE amplifier circuit.
7.5 Explain the operation of RC coupledandtransformer coupled multistage amplifier.
7.6 Describe the operation of Push-Pull amplifier.

8 **Field-Effect Transistor(FET).**

8.1 Define field effect transistor(FET).
8.2 Mention the types of FET
8.3 Describe the construction and operation Junction Field Effect Transistor (JFET).
8.4 Explain characteristics of JFET .
8.5 Describe the parameters of JFET.
8.6 Establish the relationship among FET parameters.
8.7 Describe the DC biasing of JFET and its load line.
8.8 Describe the Construction and operation of DE and E-Only MOSFET.

9. **Sinusoidal Oscillators.**

9.1 Define feedback
9.2 Describe different types of feedback with block diagram.
9.3 Calculate the gain of amplifier with feedback (positive and negative).
9.4 Mention the advantages and disadvantages of negative feedback.
9.5 Explain the principle of operation of a oscillatory tank circuit.
9.6 Describe the essentials of feedback LC oscillators.
9.7 Explain the principle of operation of Hartly, Colpitt andWein-bridge oscillators.
9.8 Explain the principle of operation phase shift & crystal oscillators.

10. **Multivibrator circuits.**

10.1 Define time base circuit.
10.2 Mention the methods of generating time base waveform.
10.3 Explain the generation of saw-tooth wave using charging and discharging of a capacitor.
10.4 Understand the features of multivibrator circuits.
10.5 State what is meant by multivibrator.
10.6 Explain the operation of astable, monostable and bistable mutivibrator circuits with wave shapes.
10.7 Mention the principle of operation of Schmitt trigger circuit.

Practical : (Using Real component and Simulation Software)

1 Show skill in identifying the electronic components.

1.1 Observe the electronic components board and read the manuals.
1.2 Identify the different types of resistors with their values, tolerance and wattage.
1.3 Identify the different types of potentiometers with their values, & wattage.
1.4 Identify the different types of capacitors with their values, dc working voltages and types.
1.5 Identify the different types of diodes & rectifiers with the numbers and specifications.
1.6 Identify the different types of transistors and thyristors with their number and specifications.
1.7 Identify the different types of LED's, IC's and miniature relays with their number & specification.
1.8 Identify different types of transformer with their specification.
1.9 Identify different inductors with their values & current ratings.
1.10 Study the printed circuit boards.
1.11 Sketch the symbols of components used in electronic circuits.
1.12 Describe the basic function of each component.
1.13 Write a report on above activities.

2 Show skill for determining the values of different resistors and capacitors with the help of color code.

2.1 Select color code resistors & capacitors of different values.
2.2 Identify the colors and their numerical numbers.
2.3 Determine the value of resistors with tolerance.
2.4 Determine the value of capacitors and dc working voltage.
2.5 Write a report on above activities.

3 Show skill in performing soldering.

3.1 Select wires (single strand and multi strand) and cut wires to required length.
3.2 Select soldering iron, soldering tag and soldering lead.
3.3 Remove wire insulation to required length.
3.4 Clean and tin both iron and work piece.
3.5 Use a tinned iron in order to transfer adequate heat to the joint.
3.6 Joint two singles& multi stranded wires mechanically and solder.

4 Show skill in soldering & de-soldering of electronic components and wires to the other components and circuit boards.

4.1 Select electronic components, wires and PCB.
4.2 Determine the rating of the soldering iron suitable for the work piece.
4.3 Clean and tin both iron & work piece.
4.4 Feed new soldering materials to the tinned and heated joint, in order to produce a correctly soldering.
4.5 Check the quality of soldering.
4.6 Clean and tin iron and de-solder the joint and components.
4.7 Use solder suckers and solder braid for de-soldering.
4.8 Write a report on the Job.

5 Show skill in checking the semi-conductor diode.

5.1 Collect a range of semi-conductor diodes and manufactures literature.
5.2 Select the digital multi-meter and set the selector switch to ohm range.
5.3 Determine the specification of semi-conductor diode.
5.4 Compare the determined specification with that of manufactures literature.
5.5 Measure forward & reverse resistances of the diode.
5.6 Identify p and p side of the diode.
5.7 Determine the condition of the diode.

6 Show skill in sketching forward and reverse characteristics curves of a semiconductor diode.

6.1 Select meter, power supply, components and materials.
6.2 Complete circuit according to circuit diagram for forward bias.
6.3 Check all connections.
6.4 Measure forward bias and corresponding forward current.
6.5 Record results in tabular form.
6.6 Connect circuit according to circuit diagram of reverse bias.
6.7 Measure reverse bias and corresponding reverse current.
6.8 Record results in tabular form.
6.9 Sketch the curves form data.

7 Show skill in sketching waves of half wave rectifier circuit.
7.1 Select meter, component, oscilloscope and materials.
7.2 Complete circuit of a half wave rectifier according to circuit diagram.
7.3 Check the circuit before operation.
7.4 Measure the input and output voltage and observe wave shapes in the oscilloscope.
7.5 Sketch the output voltage wave shape.

8 Show skill in sketching waves of full wave center tapped rectifier circuit.
8.1 Select meter, component, oscilloscope and materials.
8.2 Complete a full wave rectifier circuit according to circuit diagram.
8.3 Check the circuit supply & polarity of supply.
8.4 Measure the input & output voltages and observe wave shapes in the oscilloscope.
8.5 Sketch the output voltage wave shape.
8.6 Compare the result with half-wave rectifier circuit.

9 Show skill in constructing full wave bridge rectifier.
9.1 Select meter, component, oscilloscope and materials.
9.2 Build the circuit according to the circuit diagram.
9.3 Check the circuit.
9.4 Measure the input and output voltage.
9.5 Observe wave shape.
9.6 Compare the result with other rectifiers.

10 Show skill in identifying the terminals of bipolar junction transistor.
10.1 Select pnp & npn bipolar junction transistors.
10.2 Take AVO meter and manufacture's literature of transistor.
10.3 Identify transistor legs.
10.4 Measure base-emitter, base-collector, forward and reverse resistance.
10.5 Determine the specifications with help of manufacturer's literatures.
10.6 Identify pnp & npn transistor.

11 Show skill in determining input and output characteristics of a transistor in common emitter connection.
11.1 Select component, AVO meters, circuit board and required materials.
11.2 Construct the circuit.
11.3 Adjust the biasing voltage to appropriate point.
11.4 Record input and output voltage and current.
11.5 Plot the curve with recorded data.

12 Show skill in measuring operating points (VCE and IC) for Transistor circuit.
12.1 Select a fixed bias transistor circuit materials.
12.2 Select required equipment.
12.3 Prepare the circuit.
12.4 Check the connections
12.5 Adjust the circuit**.**

13. Demonstrate the operation of a Hartly, Colpitt and R-C oscillator.
13.1 Draw the circuit diagram.
13.2 Select tools, equipment and materials.

13.3 Connect the circuit diagram.
13.4 Check and energize the circuit.
13.5 Observe the output for different frequencies

14. Study the operation of a transistor astable, monostable& bi-stable multivibrator circuit. Select an experiment circuit.

14.1 Select the required tools and materials.
14.1 Build up the circuit as per diagram.
14.1 Switch on the power supply.
14.1 Switch on the trigger signal.
14.1 Observe the wave shapes at each collector & base of the transistor

REFERENCE BOOKS :

1. A Text Book of Applied Electronics - R.S. SEDHA
2. Principles of Electronics - V. K. Mehta

66712 ELECTRICAL ENGINEERING FUNDAMENTALS

T	P	C
3	3	4

OBJECTIVES

- To familiarize the basic electrical quantities & laws and to apply them in solving problems of electrical circuits.
- To acquaint with electro-magnetism, electro-magnetic induction.
- To develop skill in electrical wiring.
- To familiarize with DC generator, AC generator, AC motor, DC Motor & Transformers.
- To appreciate the safety measures to be taken for electrical wiring.

SHORT DESCRIPTION

Electric current; Voltage & Resistance; Conductors and insulators; Ohm's law; Kirchhoff's Law; Joule's law; Faraday's law; Basic electrical circuits; Power and energy; Electro-magnetic induction; House wiring; Controlling devices; Protective devices; Earthing; DC Motor, AC Motor, DC Generator; AC Generator; Transformer & Electricity Act/Rule.

DETAIL DESCRIPTION

Theory :

1 Understand electricity and its nature.

1.1 State the meaning of electricity.
1.2 Describe the structure of atom.
1.3 Define current, voltage and resistance with unit.

2 Understand conductor semiconductor & insulator.

2.1 Define conductor, semiconductor and insulator.
2.2 Describe the conductor, semiconductor and insulator.
2.3 List at least 5 conductors, 5 semiconductor and 5 insulators.
2.4 Describe the factors upon which the resistance of a conductor depends.
2.5 State laws of resistance.
2.6 Prove the relation $R=\rho L/A$
2.7 Explain the meaning of resistivity and unit of resistivity.
2.8 Solve problems relating to laws of resistance.

3 Understand Ohm's Law

3.1 State Ohm's law.
3.2 Deduce the relation between energy current, voltage and resistance.
3.3 Solve problems relating to Ohm's law.

4 Understand Kirchhoff's Law

4.1 State Kirchhoff's current law.
4.2 Explain the Kirchhoff's current law.
4.3 Sate Kirchhoff's Voltage law.
4.4 Explain the Kirchhoff's Voltage law.
4.5 Solve problem by Kirchhoff's Law

5 Understand electric circuit.

5.1 Define electric circuit.
5.2 Name the different types of electric circuits.
5.3 Define series circuit, parallel circuit and mixed circuit.
5.4 Describe the characteristic of series circuit and parallel circuit.
5.5 Calculate the equivalent resistance of series circuit and parallel circuit.
5.6 Solve problems relating to DC series circuit, parallel circuit and mixed circuit.
5.7 Define inductor, capacitor, inductive reactance & capacitive reactance.
5.8 Write the formula of inductive reactance, capacitive reactance & impedance.

6 Apply the concept of electrical power and energy.

6.1 Define electrical power and energy.
6.2 State the unit of electrical power and energy.
6.3 Show the relation between electrical power and energy.
6.4 Name the instruments for measuring of electrical power and energy.
6.5 Draw the connection diagram of wattmeter and energy meter in an electrical circuit.
6.6 Solve problems relating to electrical power and energy Calculation.

7 Understand the principles of Joule's law.

7.1 Explain Joule's law regarding the development of heat in electrical circuit.
7.2 Describe meaning of "J".
7.3 Solve problems relating to Joule's law.

8 Understand the Faraday's laws of Electro-magnetic Inductions

8.1 Define Electro-magnetic Inductions.
8.2 Explain Faraday's laws of Electro-magnetic Induction.
8.3 Solve problems on Electro-magnetic Induction.

9 Understand the uses of wires and cables.

9.1 Define electrical wires and cables.
9.2 Distinguish between wires and cables.
9.3 Uses of wires and cables.

10 Understand the different methods of house wiring.

10.1 State the meaning of wiring.
10.2 List the types of wiring.
10.3 State the types of wiring used in:
  a) Residential building.
  b) Workshop
  c) Cinema hall/Auditorium
  d) Temporary shed
10.4 List the name of fittings used in different types of electrical wiring.

11 Understand the controlling and protective devices & uses of them.

11.1 Define controlling device.
11.2 List the different types of controlling devices.
11.3 Define protective devices.
11.4 List the different types of protective devices.
11.5 Uses of different types of fuses used in house wiring.
11.6 Uses of different types of circuit breaker in house wiring.

12 Understand the necessity of earthing.

12.1 Define earthing.
12.2 Describe the necessity of earthing.
12.3 List of different types of earthing.

13 Understand the principle of operation of transformer.

13.1 Define transformer.
13.2 Describe the working principle of transformer.
13.3 Write the equation relating to voltage, current & turns of primary & secondary winding of transformer.
13.4 List the different losses of transformer.
13.5 Define transformation ratio (voltage, current and turns).
13.6 Solve problems on transformation ratio.

14 Concept of the principle of Electrical Machines

14.1 Define electrical machine.
14.2 list of different types of electrical machines.

14.3 Define generator.
14.4 List of different types of generator.
14.5 Uses of generator.
14.6 Define motor.
14.6 List of different types of motor.
14.7 Uses of motor.

Practical:

1 Identify and use electrical measuring instruments.

1.1 Identify Voltmeters, Ammeters, Clip-on meter, Frequency meter, Wattmeter, Energy meter and AVO meter.
1.2 Select & read the scale of given meters.
1.3 Connect correctly voltmeter, ammeter, watt meter and energy meter to a given circuit.

2 Show skill in verification of Ohm's Law.

2.1 Sketch the circuit diagram for the verification of Ohm's Law.
2.2 List tools, equipment and material required for the experiment.
2.3 Prepare the circuit according to the circuit diagram using proper equipment.
2.4 Check all connections before the circuit is energized.
2.5 Verify the law by collecting relevant data.

3 Show skill in verification of Kirchhoff's Law**.**

3.1 Sketch the circuit diagram for the verification of Kirchhoff's Law.
3.2 List tools, equipment and material required for the experiment.
3.3 Prepare the circuit according to the circuit diagram using proper equipment.
3.4 Check all connections before the circuit is energized.
3.5 Verify the laws by collecting relevant data.

4 Verify the characteristics of series and parallel circuits.

4.1 Draw the working circuit diagram.
4.2 List tools, equipment and materials required for the experiment.
4.3 Prepare the circuit according to the circuit diagram using proper equipment.
4.4 Check all connections before the circuit is energized.
4.5 Record data and verify that in a series circuit total voltage and resistance is equal to the summation of individual voltage and resistance respectively but total current is equal to the individual current.
4.6 Record data and verify that for a parallel circuit supply voltage is equal to the branch voltage, supply current is equal to summation of branch currents.

5 Show skill in measuring the power of an electric circuit.

5.1 Sketch the necessary circuit diagram of an electrical circuit with electrical load, ammeter, voltmeter and wattmeter.
5.2 Prepare the circuit according to the circuit diagram using ammeter, voltmeter and wattmeter.
5.3 Record the power, measured by the wattmeter and verify the reading with that of calculated from ammeter and voltmeter.
5.4 Compare the measured data with that of calculated and rated power.

6 Show skill in measuring the energy consumed in an electrical circuit.

6.1 Sketch the necessary diagram of an electric circuit wattmeter, energy meter and electrical load.
6.2 Prepare the circuit according to the circuit diagram user wattmeter and energy meter.
6.3 Record the energy measured by the energy meter and verify with that of calculated from wattmeter for a fixed time.

7 Show skill in uses of hand tools, wires and cables.

7.1 List the hand tools used in electrical wiring.
7.2 Identify the hand tools used in electrical wiring.

7.3 Draw neat sketches of hand tools used in electrical wiring.
7.4 Identify different types of wires and cables.
7.5 Measure the diameter of the identified wire and cables using standard wire gauge.

8 Show skill in preparing wiring circuit of two lamps controlled from two points separately.

8.1 Sketch a working circuit of two lamps controlled from two points separately.
8.2 Make the wiring circuit using required materials and equipment a wiring board.
8.3 Test the connection of circuit by providing proper supply.

9 Show skill in preparing wiring circuit of one lamp controlled from two points.

9.1 Sketch a working diagram of one lamp controlled by two SPD tumbler Switches.
9.2 Complete the wiring circuit using required materials and equipment on wiring board.
9.3 Test the connection of circuit by providing proper supply.

10 Show skill in preparing wiring circuit of one bell with two indicating lamp controlled from two points.

10.1 Sketch a working diagram of one bell with two indicating lamps controlled by two push button switch.
13.2 Make the wiring circuit using required materials and equipment in wiring board.
13.3 Test the connection of circuit by providing proper supply.

11 Show skill in preparing wiring circuit of a fluorescent tube light.

11.1 Sketch a working diagram of a fluorescent tube light circuit.
11.2 Make the connection of a fluorescent tube light circuit using required materials and equipment.
11.3 Test the connection of the circuit by providing supply.

12 Find the transformation ratio of a transformer.

12.1 Develop a circuit to perform the experiment.
12.2 Select required equipment and materials.
12.3 Connect the components according to the circuit diagram.
12.4 Check the connections.
12.5 Record the primary (E_P) and secondary (E_S) voltages.
12.6 Calculate the transformation ratio using the relation

$$\frac{E_S}{E_P} = \frac{N_S}{N_P} = K$$

12.7 Note down the observations.

13 Start a 1-phase capacitor type motor/ceiling fan with regulator.

13.1 Select the equipment and tools required for the experiment.
13.2 Sketch a working diagram.
13.3 Identify the two sets of coils.
13.4 Connect the capacitor with the proper set of coil.
13.5 Connect power supply to the fan motor.
13.6 Test the rotation of the motor opposite direction by changing the capacitor connection.
13.7 Note down the observations.

REFERENCE BOOKS

1 A text book of Electrical Technology -B. L. Theraja
2 Basic Electricity -Charles W Ryan
3 Basic Electrical theory and Practice -E. B. Babler
4 Electrical Machine -Siskind

CHT 66331 CHEMICAL ENGINERING OPERATIONS-1

T	P	C
2	3	3

AIMS

- To provide the basic concepts of fluids and their properties.
- To provide the basic concepts of flow of fluids through pipes.
- To develop knowledge and skill in the operation and maintenance of pressure and flow measuring equipment, pumps and Turbines.

SHORT DESCRIPTION

Introduction to chemical engineering; The fluid in motion; Friction in pipes; Pressure and Flow measurement; Pumping of fluids; Centrifugal pumps; Positive displacement pumps; Transportation of solids.

DETAIL DESCRIPTION

Theory:

1. Understand the basic concept of chemical engineering.

1.1 Define chemical engineering.
1.2 Explain the concepts of unit operations and unit processes.
1.3 List the important unit operations and unit processes.
1.4 Mention the importance of unit operations in process industries.

2. Understand flow of fluid

2.1 Define flow of fluid.
2.2 Explain different types of flow.
2.3 Explain Reynold's number.
2.4 Explain the equation of Continuity.
2.5 State Pressure head, velocity head, static head and total head of fluid
2.6 Express derivation of Bernoulli's equation.
2.7 Solve the problems related to equation of continuity, and Bernoulli's theorem.

3. Understand compressibility, surface tension and viscosity of fluids.

3.1 Define compressible and incompressible fluids.
3.2 Explain the Surface tension for different types of liquids.
3.3 Derive the equation of surface tension.
3.4 Describe the absolute viscosity, gravitational viscosity and kinematic viscosity of fluids.
3.5 Establish the relations between absolute viscosity, gravitational viscosity and kinematic viscosity of fluids.
3.6 Solve the problems on surface tension and viscosity of fluids.

4. Understand the friction in pipes for incompressible fluid.

4.1 Define friction losses
4.2 State different types of friction losses.
4.3 Explain the various friction losses for flowing incompressible fluids in pipes and pipe fittings.
4.4 Deduce the equation of head loss due to sudden enlargement
4.5 Deduce the equation of head loss due to sudden contraction.
4.6 Solve problems with different types of friction losses in pipes and fittings.

5. Understand the measurement of fluid pressure.

5.1 Define pressure and intensity of pressure.
5.2 Mention the properties of intensity of pressure.
5.3 Explain the intensity of pressure and pressure head in a vessel filled with fluids.
5.4 Explain side pressure, average side pressure and total side pressure of fluid in vessel.
5.5 List the pressure measuring devices including microchip based instrument.
5.6 Explain the measurement of pressure and pressure difference by piezo meter, simple U-tube manometer, inclined manometer and inverted tube manometer.
5.7 Solve the problems related to pressure and pressure measurement.

6. Understand the flow and flow measuring devices.

6.1 Define flow rate of fluid.
6.2 List the flow measuring devices.
6.3 Describe the construction and working principle of orifice meter.
6.4 Describe the construction and working principle of venturimeter.
6.5 Describe the construction and working principle of Rota meter.
6.6 Describe the construction and working principle of pitot tube.
6.7 Solve the problems related the flow measurement by an orifice meter, venturi meter and pitot tube.

7. Understand the pumping of fluids.

7.1 Define pump and pumping of fluid.
7.2 List different types of pump.
7.3 List the factors which influence the selection of pump for a particular operation.
7.4 State the meaning of the term pump heads and NPSH.
7.5 Explain different types of pump heads.
7.6 Describe series and parallel operation of pumps.
7.7 Define multistage centrifugal Pump.
7.8 Explain the back-flow of centrifugal pump and its precautions.

8. Understand the features of centrifugal pumps.

8.1 Mention the construction (major parts of a pump) and operating principle of centrifugal pumps.
8.2 Define priming, self-priming, cavitation and vortex breaker.
8.3 Classify different types of centrifugal pumps.
8.4 Explain the efficiency of centrifugal pumps.
8.5 Mention the applications of centrifugal pumps.
8.6 List the advantages and disadvantages of centrifugal pumps.
8.7 Explain the purpose, advantage and disadvantage of special type pumps like, submersible pump and ejector pump.
8.8 Solve problems on centrifugal pumps.

9. Understand the features of reciprocating pumps.

9.1 Define reciprocating pump.
9.2 List the different types of reciprocating pump.
9.3 Explain single acting reciprocating pump.
9.4 Explain double acting reciprocating pump.
9.5 Explain work done by reciprocating pump.
9.6 State the use of reciprocating pump.
9.7 State the comparison between centrifugal and reciprocating pump.
9.8 State the problems of reciprocating pump.

10. Understand the features of rotary pump.

10.1 Define rotary pump.
10.2 Mention the principle of operation of rotary pumps.
10.3 State various types (screw pump, lobe pumps and vane pump) of rotary pump.
10.4 Describe the construction and working principle of gear pump.
10.5 Mention the scope of uses of gear pump.

11. Understand the Turbines.

11.1 Define basic concepts of turbine.
11.2 List the different types of turbine.
11.3 Describe the construction and working principle of impulse turbine.
11.4 Describe the construction and working principle of reaction turbine.
11.5 Describe difference between impulse and reaction turbines.
11.6 Define water turbine governor.
11.7 Explain the function, types and uses of governor.
11.8 Describe the construction and working principle of servo-motor or relay system of hydraulic governor.

12. Understand the transportation of solids.

12.1 Define the different types of conveyors used in industries for transportation of solid.
12.2 Mention the construction and working principle of Belt conveyor for transportation of solid.
12.3 Mention the construction and working principle of Chain conveyor for transportation of solid.
12.4 Explain the working principles of elevators.
12.5 Describe the pneumatic conveying system.

Practical:

1. (a) Measure the pressure of water flowing in a pipe by piezometer tube.
   (b) Measure the pressure of water flowing in a pipe by U-tube manometer.
   (c) Measure the pressure of water flowing in a pipe with the help of inclined manometer.
2. (a) Measure the flow rate of water with the help of orifice meter.
   (b) Measure the flow rate of water with the help of venture meter.
   (c) Measure the flow rate of water with the help of Rota meter.
3. (a) Determine the head loss due to friction in pipe.
   (b) Determine the head loss due to
      (i) Sudden enlargement and
      (ii) Sudden contraction in the pipe diameter.
4. (a) Perform the operation of a centrifugal pump.
   (b) Determine the suction head, delivery head and efficiency of a centrifugal pump.
   (c) Determine the water horse power (W.H.P.) of a centrifugal pump.
5. (a) Disassemble and then reassemble a volute type centrifugal pump.
   (b) Disassemble and then reassemble a diffuser type centrifugal pump.
6. Disassemble and reassemble a multistage centrifugal pump
7. Disassemble and reassemble of a reciprocating pump
8. Disassemble and reassemble of a gear type rotary pump

REFERENCE BOOKS

1. Introduction to Chemical Engineering. – W. L. Badger and J.T. Banchero.
2. Chemical Engineering (Vol-1 to Vol-5) - Coulson & Richardsons.
3. Unit Operations of Chemical Engineering. - W.l. Mc Cabe and J.C Smith

4. Unit operations of chemical engineering - p. Chattopadhyay.
5. Centrifugal Pumps and Blowers - Austin W. Church and Jagodish Lal.
6. হাইড্রলিক্স এন্ড হাইড্রলিক মেশিনারি - বাংলাদেশ কারিগরি শিক্ষা বোর্ড, ঢাকা।

Code: 66332 CHEMICAL ENGINEERING MATERIALS

T	P	C
2	3	3

AIMS

To be able to

- Identify and classify the materials used for chemical engineering field.
- Recognize the sources of various chemical engineering materials.
- Understand the characteristics of various chemical engineering materials.
- Understand the uses of different chemical engineering materials.

SHORT DESCRIPTION

Aspects of chemical engineering materials; Engineering properties and application of Stone and Tiles; Bricks; Sand; Lime; Cement; Glass and Ceramics; Paints and varnishes, Timber; Heat and Sound insulating materials**;** Fire and Waterproofing materials; Plastic and plastic materials; Aluminum as construction materials; Metals and Alloys; Conducting, Magnetic, Optical fiber and Gallium& Arsenide Materials.

DETAIL DESCRIPTION

1 Understand the various aspects of chemical engineering materials.

1.1 Define chemical engineering materials.
1.2 Mention the classification of chemical engineering materials in different technology
1.3 List the characteristics of chemical engineering materials.
1.4 Explain the importance of chemical engineering materials in other engineering sector.

2 Understand the application of stone and tiles

2.1 Define stones and tiles.
2.2 Mention the physical and chemical classification of stones.
2.3 List the characteristics of good stones.
2.4 Describe the dressing of stones.
2.5 Describe the uses of stone and tiles in engineering field.
2.6 State Clay tiles, Homogeneous tiles, Plastic tiles, Glazed tiles, Marble tiles and Mosaic.

3 Understand the application of brick.

3.1 Define brick.
3.2 Mention constituents of a good brick.
3.3 Explain the table molding and machine molding.
3.4 Describe the drying processes of brick.
3.5 Describe the burning processes of brick.
3.6 Describe manufacturing processes of Block Brick.

4 Understand the application of sand.

4.1 Mention the classification of sand according to their sources.
4.2 Mention the specifications of good sand.
4.3 Describe the purpose of grading of sand.
4.4 Mention the uses of various grades of sand.

5 Understand the application of Lime.

5.1 Define lime, Calcination, Hydraulicity and Quick lime.
5.2 Describe the Classification of lime.
5.3 Mention the properties of good lime.
5.4 Explain the manufacturing process of lime.
5.5 State the uses of different kinds of lime.
5.6 Describe the storage of lime.

6 Understand the concept of cement.

6.1 Define cement.
6.2 Mention the functions of various ingredients of cement.
6.3 Distinguish between wet process and dry process of manufacturing Portland cement.
6.4 Draw a flow diagram of manufacturing of cement (wet process).
6.5 Mention the uses of cement as chemical engineering material.

7 Understand the basic concepts of glass and ceramics.

7.1 Mention the constituents of glass.
7.2 List the properties of glass.
7.3 State the classification of glass.
7.4 Mention the uses of glass.

7.5 Describe the constituents of ceramics.
7.6 Mention the classification of ceramics.
7.7 Describe the uses of ceramics in engineering field.

8 Understand the basic concepts of paints and varnishes.

8.1 Define paint and varnish.
8.2 Explain the characteristics of good paint.
8.3 List the essential constituents of paint.
8.4 Explain the functions of pigment.
8.5 List the main constituents of varnishes.
8.6 Explain the characteristics of good varnish.
8.7 Describe synthetic materials used for paint and varnish.

9 Understand insulating materials.

9.1 Mention the functions of insulating materials.
9.2 List five natural heat insulating materials.
9.3 Mention the names of synthetic insulating materials.
9.4 Describe the sources of obtaining rubber, cork and ebonite.
9.5 Describe the properties and uses of asbestos as insulating materials.
9.6 List of sound absorbing materials.

10 Understand the fire and water proofing materials.

10.1 State fire proofing and water proofing materials.
10.2 Explain the important of fire and water proof materials used in chemical industries.
10.3 Explain the uses of asbestos as fire and water proof materials.
10.4 List the characteristics of refractory materials.
10.5 Explain the uses of rubber as water proofing material.

11 Understand plastic and plastic materials.

11.1 Define plastic.
11.2 List the name of raw materials of plastic.
11.3 Explain the properties of plastic.
11.4 Mention the characteristics of thermoplastic and thermosetting plastic.
11.5 Describe the manufacturing processes of plastic.
11.6 Explain the molding methods of plastic products.
11.7 Explain the uses of plastic as engineering materials.

12 Understand the engineering uses of metals and alloys.

12.1 Define alloy metal.
12.2 Mention the uses of wrought iron and cast iron.
12.3 Mention the classification of steel on the basis of carbon content.
12.4 List the names of commercial steels.
12.5 Describe the importance of aluminum foil in packaging industries.
12.6 Mention the uses of aluminum /white metals.

13 Understand the Engineering use of Conducting, Magnetic, Optical fiber and Gallium Arsenide Materials

13.1 State the conducting, semi-conducting and non-conducting materials.
13.2 Describe the uses of semi-conducting materials.
13.3 Name the types of soft and hard magnetic materials.
13.4 Mention the uses of optical fiber.
13.5 Mention the uses of Gallium and Arsenide Materials.

PRACTICAL:

1. Show skill in identifying various types of stone
   (a) Select different type of stone in the laboratory
   (b) Sketch different type of stones on the basis of formation
   (c) Chemical test of tiles (Surface color test)
2. Show skill in test of bricks
   (a) Perform field test of bricks
   (b) Select 1st class, 2nd class, 3rd class bricks and Jhama bricks
3. Show skill in conducting test of bricks
   (a) Compression test
   (b) Absorption test
   (c) Average weight.
4. Show skill in conducting test of sand
   (a) Bulking of sand

(b) F M of sand
(c) Specific gravity of sand
(d) Moisture in silica sand

5. Show skill indetermination fineness test of cement.
6. Show skill in identifying physical properties of quartz, feldspar, china clay, ball clay, fair clay
7. Show skill in removal of bond moisture in clay physically and chemically.
8. Show skill in determination of loss on ignition of china clay.
9. Show skill in determination the water of plasticity of ball clay

REFERENCE BOOKS

1	A text book on Engineering Materials	—	G. J. Kulkarni
2	Engineering Materials	—	Dr. M. A. Aziz
3	Plastic Materials	—	J. A Brydson
4	A Text Book of Engineering Materials	__	Dr. M.A.Aziz
5	Ceramic engineering materials 1 & 2	__	BTEB