



BANGLADESH TECHNICAL EDUCATION BOARD
Agargoon, Dhaka-1207.

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

CHEMICAL TECHNOLOGY

TECHNOLOGY CODE: **663**

4th SEMESTER

DIPLOMA IN ENGINEERING
PROBIDHAN-2016

CHEMICAL TECHNOLOGY (663)

4th 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	65841	Business Organization & Communication	2	0	2	40	60	0	0	100
2	66341	Chemical Engineering Operation-2	2	3	3	40	60	25	25	150
3	66342	Chemical process Industries-1	2	3	3	40	60	25	25	150
4	66343	Industrial Chemistry	2	3	3	40	60	25	25	150
5	66344	Oil, Fats & Waxes	1	3	2	20	30	25	25	100
6	66345	Analytical Chemistry	2	3	3	40	60	25	25	150
7	66346	Basic Production Engineering	2	3	3	40	60	25	25	150
Total			13	18	19	260	390	150	150	950

AIMS:

- To be able to understand the basic concepts and principles of business organization.
- To be able to understand the banking system.
- To be able to understand the trade system of Bangladesh.
- To be able to understand the basic concepts of communication and its types, methods.
- To be able to perform in writing, application for job, complain letter & tender notice.

SHORT DESCRIPTION:

Principles and objects of business organization; Formation of business organization; Banking system and its operation; Negotiable instrument; Home trade and foreign trade. Basic concepts of communication Communication model & feedback; Types of communication; Methods of communication; Formal & informal communication; Essentials of communication; Report writing; Office management; Communication through correspondence; Official and semi- official letters.

DETAIL DESCRIPTION:**Theory:****1 Concept of Business organization.**

- 1.1 Define business.
- 1.2 Mention the objects of business.
- 1.3 Define business organization.
- 1.4 State the function of business organization.

2 Formation of Business organization.

- 2.1 Define sole proprietorship, partnership, Joint Stock Company. and co-operative
- 2.2 Describe the formation of sole proprietorship, partnership, joint stock Company, & co operative.
- 2.3 Mention the advantages and disadvantages of proprietorship, partnership and Joint Stock Company.
- 2.4 State the principles of Co operative & various types of Co operative.
- 2.5 Discuss the role of co-operative society in Bangladesh.

3 Basic idea of Banking system and negotiable instrument.

- 3.1 Define bank.
- 3.2 State the service rendered by bank.
- 3.3 Describe the classification of bank in Bangladesh.
- 3.4 State the functions of Bangladesh Bank in controlling money market.
- 3.5 State the functions of commercial Bank in Bangladesh
- 3.6 Mention different types of account operated in a bank.
- 3.7 Mention how different types of bank accounts are opened and operated.
- 3.8 Define negotiable instrument.
- 3.9 Discuss various types of negotiable instrument.
- 3.10 Describe different types of cheque.

4 Home & foreign trade

- 4.1 Define home trade.
- 4.2 Describe types of home trade.
- 4.3 Define foreign trade.
- 4.4 Mention the advantages and disadvantages of foreign trade.
- 4.5 Discuss the import procedure & exporting procedure.
- 4.6 Define letter of credit.
- 4.7 Discuss the importance of foreign trade in the economy of Bangladesh.

5 Basic concepts of communication

- 5.1 Define communication & business communication.
- 5.2 State the objectives of business communication.
- 5.3 Describe the scope of business communication.
- 5.4 Discuss the essential elements of communication process.

6 Communication model and feedback.

- 6.1 Define communication model.
- 6.2 State the business functions of communication model.
- 6.3 Define feedback.
- 6.4 State the basic principles of effective feedback.

7 Types and Methods of communication.

- 7.1 Explain the different types of communication;-
 - a) Two-way communication
 - b) Formal & informal communication
 - c) Oral & written communication
 - d) Horizontal & vertical communication
 - e) external & internal communication
 - f) Spoken & listening communication.
- 7.2 Define communication method.
- 7.3 Discuss the various methods of communication.
- 7.4 Distinguish between oral and written communication.

8 Essentials of communication.

- 8.1 Discuss the essential feature of good communication.
- 8.2 Describe the barriers of communication.
- 8.3 Discuss the means for overcoming barriers to good communication.

9 Report writing.

- 9.1 Define report, business report & technical report.
- 9.2 State the essential qualities of a good report.
- 9.3 Describe the factors to be considered while drafting a report.
- 9.4 Explain the components of a technical report.
- 9.5 Prepare & present a technical report.

10 Office management.

- 10.1 Define office and office work.
- 10.2 State the characteristics of office work.
- 10.3 Define filing and indexing.
- 10.4 Discuss the methods of filing.

10.5 Discuss the methods of indexing.

10.6 Distinguish between filing and indexing.

11 Official and semi-official letters.

11.1 State the types of correspondence.

11.2 State the different parts of a commercial letter.

11.3 Define official letter and semi-official letter.

11.4 Prepare & present the following letters: Interview letter, appointment letter, joining letter and application for recruitment. Complain letters, tender notice.

REFERENCE BOOK:

1. উচ্চ মাধ্যমিক ব্যবসায়নীতি ও প্রয়োগ -মোহাম্মদ খালেকুজ্জামান
2. উচ্চ মাধ্যমিক ব্যাংকিং ও বীমা -প্রফেসর কাজী নুরুল ইসলাম ফারুকী
3. আধুনিক কারবার পদ্ধতি -লতিফুর রহমান
4. কারবার যোগাযোগ ও সচিবের কার্যপদ্ধতি -প্রফেসর লতিফুর রহমান ও প্রফেসর কাজী নুরুল ইসলাম ফারুকী
5. ব্যবসায়িক যোগাযোগ এবং অফিসের কর্মপ্রণালী -ড. এম, এ, মান্নান
6. ব্যবসায় যোগাযোগ – মোহাম্মদ খালেকুজ্জামান ও মোঃ মুশাররফ হোসেন চৌধুরী
7. Business organization & management- M.C. Shukla
8. Business organization & management- R.N. Gupta

AIMS

- To provide knowledge and skills of heat transfer, heat exchangers, boilers and heat insulating materials.
- To develop knowledge and skill in operation and maintenance of heat exchanger, boiler, water treatment plant.

SHORT DISCRIPTION

Heat transfer by conduction, convection and radiation; Heat exchangers; Boilers; Boiler mountings & accessories; Properties & uses of steam; Thermal insulation.

DETAIL DESCRIPTION**Theory:****1. Understand the concept of heat transfer.**

- 1.1 Define heat transfer.
- 1.2 Mention the basic considerations of heat transfer.
- 1.3 Explain the meaning of “heat transfer co-efficient” and “overall heat transfer co-efficient”.
- 1.4 Explain the meaning of “log mean temperature difference (LMTD)”.
- 1.5 Solve the problems on overall heat transfer co-efficient and log mean temperature difference.

2. Understand the heat transfer by conduction.

- 2.1 State Fourier’s law.
- 2.2 State thermal conductivity and its units.
- 2.3 Explain the conduction of heat through a plane wall.
- 2.4 Explain the thermal resistances in series.
- 2.5 Explain the conduction through a thick-walled tube.
- 2.6 Explain the conduction through a sphere.
- 2.7 Solve problems on heat transfer by conduction.

3. Understand the heat transfer by convection.

- 3.1 Define heat transfer by convection.
- 3.2 Explain the film coefficient for convection.
- 3.3 Explain different types of convection.
- 3.4 Deduce the equation for overall heat transfer coefficient.
- 3.5 Solve problems on heat transfer by convection.

4. Understand the heat transfer by radiation.

- 4.1 Define heat transfer by radiation.
- 4.2 Define absorptivity, reflectivity and transmissivity of heat through a body.
- 4.3 State the meaning of black body, white body and gray body.
- 4.4 Explain the Kirchoff’s law of heat transfer by radiation.
- 4.5 Explain the energy emission by a black body.

5. Understand the features of heat exchangers.

- 5.1 Define heat exchangers.
- 5.2 List the different types of heat exchangers.
- 5.3 Explain shell and tube heat exchanger, finned tube heat exchanger and plate heat exchanger.
- 5.4 Draw and explain the temperature profile of parallel current and counter current heat exchangers.

- 5.5 Explain log mean temperature difference (LMTD) for parallel-current and counter current heat exchangers.
- 5.6 Solve problems on heat exchangers.

6. Understand the features of boilers.

- 6.1 Define boiler.
- 6.2 Mention the classification of boilers.
- 6.3 Distinguish between internally fire tube and externally fire tube boiler.
- 6.4 Write the advantages and disadvantages of fire tube boiler and water tube boiler.
- 6.5 Explain the construction and operation of common types of boiler.
- 6.6 Mention the precautions for boiler operation system.
- 6.7 State the general maintenance of boilers.

7. Understand the features of boiler mountings.

- 7.1 State boiler mountings.
- 7.2 List the main boiler mountings.
- 7.3 Mention the functions of water level indicator, plain gauge glass, pressure gauge and safety valve of a boiler.
- 7.4 Explain the working principles of common safety valves.
- 7.5 Describe the construction and working principle of feed check valve, blow down cock and fusible plug.

8. Understand the features of boiler accessories.

- 8.1 State the meaning of boiler accessories.
- 8.2 List different types of boiler accessories.
- 8.3 Explain feed water regulator, economizer, feed water strainer, steam purifier, steam trap and super heater.
- 8.4 Mention the functions of various boiler accessories.

9. Understand the features of boiler auxiliaries.

- 9.1 State the meaning of boiler auxiliaries.
- 9.2 List different types of boiler auxiliaries.
- 9.3 Explain feed water pump, water injector, feed water heater (economizer), air pre heater and condenser.
- 9.4 Mention the functions of various boiler auxiliaries.
- 9.5 Mention the specification of boiler feed water.

10. Understand the aspects of steam.

- 10.1 Define steam.
- 10.2 State the meaning of dry steam, wet steam, saturated steam and superheated steam.
- 10.3 Mention the properties of saturated steam and superheated steam.
- 10.4 List the uses and advantages of superheated steam.
- 10.5 Mention the uses of steam table

11. Understand the aspects of thermal insulation.

- 11.1 State the meaning of thermal insulation.
- 11.2 List the thermal insulating materials.
- 11.3 Mention the characteristics of thermal insulating materials.
- 11.4 Mention the application of thermal insulation.
- 11.5 State the economic thickness of lagging by thermal insulating materials.

PRACTICAL:

1. Operate a double pipe heat exchanger.
2. Demonstrate and operate a shell and tube heat exchanger.
3. Demonstrate and operate an air cooled condenser.
4. Demonstrate and operate a water cooled condenser.
5. Construct a solar dryer to study the heat absorptivity of a black body.
6. Demonstrate and operate a water tube boiler.
7. Identify the auxiliaries and accessories of a water tube boiler

8. Demonstrate and operate a fire tube boiler.
9. Perform the maintenance of a fire tube boiler.
10. Demonstrate and operate an electric boiler.

REFERENCE BOOKS

1. Chemical Engineering operation-2 - Engr. A K Md. WahidulHaque
2. Heat Transfer — J.P. Hollman
3. 3Chemical Engineering, Volume I and II (Third edition) - M Coulson and J. F. Richardson
4. Introduction to Chemical Engineering — Badger and Banchero
5. Chemical Engineering Hand Book - Perry
6. Boiler - Muhammad Mahboobur Rahman & Muhammad AshiqurRahman

AIMS

- To be able to understand the basic concepts of water treatment, manufacturing of pigments, paints, enamel, and varnishes, starch, leather processing, glue and gelatin, textile processing, dyeing printing and finishing and abrasive.
- To develop skill in water treatment and testing, paint manufacturing, varnish manufacturing, manufacturing technology of starch, chrome and vegetable tanning and wet process for yarn, technique of dyeing and printing, preparation of glue and gelatin,

SHORT DESCRIPTION

Concept of water treatment and analysis of water; Environmental protection and waste water treatment; Aspects of pigments, paints manufacturing; Aspects of varnishes, enamels and lacquers, paints and varnishes; Concepts of Starch; Aspects of leather processing; Production of glue and gelatin; Basic idea of textile processing, dyeing, printing & finishing and concept of abrasive.

DETAIL DESCRIPTION**Theory:****1. Understand the concept of water treatment.**

- 1.1 Define water treatment.
- 1.2 Make a list of impurities in water.
- 1.3 Define turbidity and salinity of water.
- 1.4 Describe the water treatment process for municipal purpose with flow sheet.
- 1.5 Describe the softening of water by lime-soda process.
- 1.6 State the softening of water by organic ion exchange process.
- 1.7 Describe the methods of obtaining fresh water from saline water with flow chart.
- 1.8 Describe the demineralization process for industrial water.
- 1.9 State the process of water treatment for high pressure boilers.

2. Understand the analysis of water.

- 2.1 Mention the analysis of industrial water.
- 2.2 Describe the determination method of temporary hardness of water.
- 2.3 Describe the determination method of permanent hardness of water.
- 2.4 State the river osmosis process.
- 2.5 Explain the Arsenic test of water.
- 2.6 Solve the problems on hardness of water.

3. Understand the environmental protection and waste water treatment in chemical industries.

- 3.1 Mention the sources of environmental pollution in chemical industries.
- 3.2 Define water pollution.
- 3.3 List the different types of water pollutants.
- 3.4 Describe the sources of water pollution.
- 3.5 Mention primary, secondary and tertiary treatment of waste water in chemical industries.
- 3.6 Draw the flow chart for the treatment of waste water/sewage by activated sludge's process in municipal /city corporation /industry waste water/sewage treatment plant.
- 3.7 Describe the pressure membrane process for the treatment of waste water.
- 3.8 Describe the trickling filters method for the treatment of waste water in industries.

4. Understand the aspects of pigment manufacturing.

- 4.1 Define pigments.
- 4.2 Make a list of pigments.
- 4.3 Explain manufacturing process of white pigment (white lead and zinc oxide).
- 4.4 Explain manufacturing methods of ultramarine blue.
- 4.5 Explain manufacturing process of carbon black and lithopone.
- 4.6 Describe manufacturing process of red lead and chrome green.

5. Understand the aspects of paint manufacturing.

- 5.1 Define paint.
- 5.2 State the classification and different tests of paints.
- 5.3 Mention the properties of a good paint.
- 5.4 List the constituents of paint.
- 5.5 Explain the functions of paint constituents.
- 5.6 State the setting of paint.
- 5.7 Describe manufacturing process of paint with flow chart.

6. Understand the aspects of varnishes, enamels and lacquers.

- 6.1 State the meaning of varnishes, enamels and lacquers.
- 6.2 List the raw materials used for the manufacturing of varnishes.
- 6.3 Explain manufacturing process of varnishes.
- 6.4 Mention the uses of varnishes.
- 6.5 Describe the manufacturing process of enamels.
- 6.6 List the constituents of lacquers.
- 6.7 Describe the manufacturing process of lacquer.
- 6.8 Mention the uses of lacquer.

7. Understand the concepts of Starch.

- 7.1 Define starch.
- 7.2 Mention chemical structure of starch.
- 7.3 Describe the manufacturing process of starch from corn or maize.
- 7.4 State application of starch.
- 7.5 Explain dextrin or roasted starch.
- 7.6 Describe preparation of dextrin or roasted starch.
- 7.7 Mention the uses of dextrin starch.

8. Understand the aspects of leather processing.

- 8.1 Define leather processing.
- 8.2 State tanning.
- 8.3 Explain the vegetable tanning process for the manufacture of finished leather.
- 8.4 Explain the chrome tanning process with flow chart for the manufacturing of finished leather.
- 8.5 Differentiate between vegetable tanning and chrome tanning.

9. Understand glue and gelatin.

- 9.1 Define glue and gelatin.
- 9.2 Explain the manufacturing process of glue.
- 9.3 Describe the manufacturing process of gelatin.
- 9.4 Mention the uses of glue and gelatin.

10. Understand basic idea of textile processing.

- 10.1 Define wet process.
- 10.2 Classify wet process system.
- 10.3 Draw a flow-chart of wet process for yarn.
- 10.4 State singeing and de-sizing.
- 10.5 Mention the purposes of singeing.
- 10.6 Define scouring.
- 10.7 Mention the purpose of scouring.

11. Understand basic idea of dyeing, printing & finishing.

- 11.1 Define color, dye & dyeing.
- 11.2 Mention the purpose of dyeing.
- 11.3 List the commercially important dyes with their commercial names.
- 11.4 Describe the general idea of dying.
- 11.5 Define the printing.
- 11.6 Mention the purposes of printing.
- 11.7 List the methods of printing.
- 11.8 Describe general idea of printing.
- 11.9 Explain general idea of Textile finishing.

12. Understand the concept of abrasive.

- 12.1 Define abrasive.
- 12.2 Explain properties of abrasive.
- 12.3 Mention importance abrasive name.
- 12.4 Explain manufacturing process of silicon carbide, fused alumina and boron carbide.
- 12.5 Describe preparation method of grinding wheel.
- 12.6 Explain the uses of silicon carbide, fused alumina and boron carbide.

PRACTICAL:

- 1. Determine the temporary hardness of water.
- 2. Determine the permanent hardness of water.
- 3. Treat the hard water by lime-soda process.
- 4. Determine the salinity of supply water.
- 5. Determine the turbidity of supply water.
- 6. Draw the flow chart for waste water treatment of chemical industry.
- 7. Draw the flow chart for sewage water treatment of municipal or City Corporation.
- 8. Prepare the paint in laboratory process.
- 9. Prepare the wood varnish and enamel in laboratory process.
- 10. Draw the flow chart for manufacturing of starch from corn or maize.
- 11. Visit at least two related industry and submit a report on it.

REFERENCE BOOKS

- | | |
|--|-----------------------------------|
| 1 Shreve's Chemical Process Industries | -George T. Austin |
| 2 Dryden's Outlines of Chemical Technology | -M.Gopala Rao and Marshall Sittig |
| 3 Industrial Chemistry (Vol-I & II) | -R.K. Das |
| 4 Modern Applied Chemistry | -A.N. Zamre, V.G. Ratollikar |
| 5. Industrial Chemistry | -B.K. Sharma |

AIMS:

- To be able to understand the concept of inorganic and organic chemistry (industrial chemistry).
- To develop knowledge and skill in studies of inorganic and organic chemistry
- To be able to develop skill in analyzing chemical compounds. (Inorganic and Organic compounds)

SHORT DESCRIPTION:

Significance quantum number; modern concept of oxidation-reduction titration and iodimetry & iodometry, feature of organic compounds, Saturated hydrocarbon, unsaturated hydrocarbon, polycyclic and heterocyclic hydrocarbon, alcohols, aldehyde and ketone, fatty acid and its derivatives, acetic acid, Aromatic compounds, carbohydrates and bio-molecular chemistry.

Theory:**1. Understand the aspects of quantum numbers.**

- 1.1 Define quantum number.
- 1.2 List the four quantum numbers and significance of quantum numbers.
- 1.3 Describe quantum numbers.
- 1.4 Explain energy levels, shells and sub-shells.
- 1.5 Explain difference between an orbit and orbital.
- 1.6 Explain the terms:
 - a) Atomic number
 - b) Gram atom
 - c) Molecular mass number
 - d) Atomic mass number
- 1.7 Show the distribution of electrons: Li_3 , Be_4 , N_7 , Ne_{10} , Na_{11} , S_{16} , Cl_{17} , K_{19} , Ca_{20} , Fe_{26} , Cu_{29} and Zn_{30}

2. Understand the oxidation-reduction titration and iodimetry & iodometry.

- 2.1 Define titration.
- 2.2 Explain indicators and write the name of ten chemical indicators.
- 2.3 Explain iodimetry and iodometry.
- 2.4 Explain the manufacturing process of starch solution.
- 2.5 Standardization of thiosulphate solution by standard $\text{K}_2\text{Cr}_2\text{O}_7$ solution by idiomatic methods.
- 2.6 Explain preparation procedure of standard 0.1N iodine solution.

3. Understand the feature of organic compounds.

- 3.1 State the meaning of organic compounds.
- 3.2 Mention the nomenclature of organic compounds in IUPAC system.
- 3.3 Explain the classification of organic compounds.
- 3.4 Explain the homologous series of organic compounds.
- 3.5 Describe alkenes, alkenes and alkynes.
- 3.6 Explain the functional group of organic compounds.

4. Understand the feature of saturated hydrocarbon.

- 4.1 Explain the meaning of hydrocarbon, saturated hydrocarbon and unsaturated hydrocarbon.
- 4.2 Describe the properties of saturated hydrocarbon.
- 4.3 State general formula of alkenes and alkynes.
- 4.4 Explain Physical and chemical properties of Methane.

4.5 Explain Physical and chemical properties of Ethane.

4.6 Explain the uses of methane and ethane.

5. Understand the feature of unsaturated hydrocarbon.

5.1 Define Alkenes and Alkynes.

5.2 Describe the properties of unsaturated hydrocarbon.

5.3 Describe the preparation of Ethylene.

5.4 Explain Physical and chemical properties of ethylene.

5.5 Describe the preparation of Acetylene.

5.6 Explain Physical and chemical properties of Acetylene.

6. Understand the feature of alcohols.

6.1 State the meaning of alcohols.

6.2 Explain the functional group of alcohols.

6.3 Mention the classification of alcohols.

6.4 Mention the structure formula of four alcohols.

6.5 Explain the primary, secondary and tertiary alcohols.

6.6 Explain the manufacturing of ethyle alcohols.

6.7 Explain the manufacturing process of ethyle alcohols from starch by fermentation.

6.8 Explain following terms:

- (a) Fermentation, (b) Methylated spirit, (c) Rectified spirit, (d) Power alcohol,
- (e) Enzyme, (f) Saponification.

6.9 Uses of alcohols.

7. Understand the feature of aldehyde and ketone.

7.1 Define aldehyde and ketone.

7.2 State the functional radical of aldehyde and ketone.

7.3 Explain the preparation of formaldehyde.

7.4 Mention the properties of formaldehyde.

7.5 Write the uses of formaldehyde.

7.6 State the meaning of formalin and its uses.

8. Understand the fatty acid and its derivatives.

8.1 Define fatty acids.

8.2 Define derivatives of fatty acids.

8.3 Explain esterification.

8.4 State formic acid and acetic acid.

8.5 Describe the uses of formic acid.

9. Understand the feature of acetic acid.

9.1 Explain the industrial manufacturing of acetic acid.

9.2 Mention the physical and chemical properties of acetic acid.

9.3 Mention the uses of acetic acid.

9.4 Explain the preparation of ethyl acetate.

9.5 Mention the properties of ethyl acetate.

9.6 Mention the uses of ethyl acetate.

10. Understand the feature of Aromatic compounds.

10.1 State the meaning of aromatic compounds.

10.2 List the important aromatic compounds.

10.3 Explain the difference between aliphatic and aromatic compounds.

10.4 Explain the preparation of benzene.

10.5 Mention the uses of benzene.

- 10.6 Explain the preparation of toluene.
- 10.7 Mention the uses of toluene.
- 10.8 Explain the preparation of 2-4-6 Tri-nitro toluene (TNT).
- 10.9 Mention the uses of TNT (Tri-nitro toluene).

11. Understand the feature of carbohydrate.

- 11.1 Explain the term carbohydrates.
- 11.2 Mention the classification of carbohydrates.
- 11.3 List the example of carbohydrates
- 11.4 Explain the preparation of glucose.
- 11.5 Mention the physical and chemical properties of glucose.
- 11.6 List the uses of glucose.
- 11.7 State the meaning of sucrose.
- 11.8 Mention the properties of sucrose.

12. Understand the feature of bio-molecular chemistry.

- 12.1 Define isomerism and optical isomer.
- 12.2 State reducing and non-reducing sugar.
- 12.3 Explain cellulose and uses of cellulose.
- 12.4 Explain protein and composition of protein.
- 12.5 Describe the classification of protein.
- 12.6 Explain enzyme and enzyme inhibitor.
- 12.7 Describe nucleic acid and classification of nucleic acid

PRACTICAL:

- 1. Standardization of sodium thiosulphate solution with 0.1N iodine solution by iodimetric method.
- 2. Measure the melting point of hydrocarbon (Dalda) by capillary tube.
- 3. Perform the flashing test of ethyl alcohol
- 4. Determine primary, secondary & tertiary alcohols by Lucas reagent.
- 5. Oxidation test, Esterification (Ethyle acetate) test and Iodoform test of ethyle alcohol.
- 6. Measure the melting point of glucose, urea, oxalic acid by capillary tube.
- 7. Systematic qualitative analysis for identification of unknown organic sample (glucose, sucrose, acetic acid & formaldehyde).
- 8. Visit at least one starch and glucose manufacturing factory.

REFERENCE BOOK:

- 1. General chemistry- Md. Rafiqul Islam.
- 2. Organic chemistry- Md. Nurul Haque Mia.
- 3. Practical chemistry (degies) - Md. Nurul Haque Mia.
- 4. Understanding chemistry part- III
- 5. White wares production – W. RYAN

AIM:

- To understand the historical background and sources of oils, fats and waxes.
- To understand production methods of oils, fats and waxes.
- To understand uses and importance of oils, fats and wax.
- To understand economical importance of oils, fats and wax.
- Able to analysis the product of oils, fats and waxes.
- Able to draw the flow sheet for production of oils, fats and waxes.

SHORT DESCRIPTION

Historical background of oils, fats and waxes; Basic concept of oils, fats and waxes; vegetable oils, processing of oils, refining of oils, animal oils and waxes, fat and fat splitting, test of fats and oils .

DETAIL DESCRIPTION**Theory:**

- 1. Historical background of oils fats and waxes.**
 - 1.1 State historical background of oils, fats and waxes.
 - 1.2 Mention the sources of oils, fats and waxes.
 - 1.3 Write the names of oils, fats and waxes
 - 1.4 Show structural formula of oils and fats.
 - 1.5 State physical and chemical properties of oil and fats.
 - 1.6 Describe industrial uses of oils, fats and waxes.
 - 1.7 Describe the importance of oils, fats and waxes in economic of Bangladesh.
- 2. Understand the basic concept of oils.**
 - 2.1 Define oil, **fats and waxes**.
 - 2.2 Classify oils.
 - 2.3 State essential oil and mineral oils.
 - 2.4 Define edible oil and inedible oils.
 - 2.5 Differentiate between edible and inedible oils.
 - 2.6 Mention the chemical composition of oil.
 - 2.7 Describe the properties of oil.
 - 2.8 Define FFA, Iodine Value, Saponification Value**
- 3. Understand the vegetable oils.**
 - 3.1 Define vegetable oil.
 - 3.2 List of important vegetable oils.
 - 3.3 Explain oil extraction from cotton seed with flow sheet.
 - 3.4 Describe the production of soybean oil from soybean seed by solvent extraction process.
 - 3.5 Describe the extraction of vegetable oils in expression process or hydraulic process.
 - 3.6 Describe the production of coconut oil, palm oil and linseed oil with flow sheet.
 - 3.7 Describe the production process of rice bran oil and sunflower oils.
- 4. Understand the processing of edible oils.**
 - 4.1 Define processing of oil.

- 4.2 Define drying and non-drying oil
- 4.3 State saturated and unsaturated oil.
- 4.4 Define bleaching of oil.
- 4.5 State hydrogenation of oil.
- 4.6 Define deodorizing of oils.
- 4.7 Explain the process diagram of hydrogenation of vegetable oil.
- 4.8 Describe the manufacturing process of mustard oil.

5. Understand the refining of edible oils.

- 5.1 Define crude oil.
- 5.2 Define refining of crude oil.

5.3 Define CDSO

5.4 Describe neutralization process of crude oil

- 5.5 Describe bleaching and deodorization process of oil.
- 5.6 Draw the flow sheet for the refining of vegetable oil.
- 5.7 Draw the flow chart for continuous refining process of edible oil.

7. Understand the animal oils.

- 6.1 Define animal oil.
- 6.2 Make a list of important animal oils.
- 6.3 Describe the production of cod liver oil with flow sheet.
- 6.4 Describe the production of lard with flow sheet.
- 6.5 Mention the uses of animal oil.

7. Understand fat and fat splitting.

- 7.1 Define fat.
- 7.2 Mention classification of fat.
- 7.3 Define fat splitting.
- 7.4 State fatty acid.
- 7.5 Mention the uses of fat and fatty acids.
- 7.6 Define saponification value, acid value and iodine value
- 7.7 Describe the production of fatty acid by using fractionating column.
- 7.8 Describe fat splitting process.
- 7.9 Describe the extraction of tallow oil.

8. Understand the waxes.

- 8.1 Define waxes.
- 8.2 List different types of waxes.
- 8.3 Mention the uses of waxes.
- 8.4 State bees wax, paraffin wax, synthetic wax, Chinese wax, wool wax, liquid wax spermaceti wax, carnauba wax and vegetable wax.
- 8.5 Describe the production process of bees wax and synthetic wax.

PRACTICAL:

- 1. Determine the saponification value of oils and fats.
- 2. Determine the acid value of supplied sample of oils and fats.
- 3. Determine the iodine value of supplied sample of oil and fat.
- 4. Extraction of mustard oil by soxhlet apparatus.

5. Draw a flow chart for production of soybean oil from soybean seed.
6. Draw a flow chart for hydrogenation of oil in wet process.
7. Draw a flow sheet for continuous process of edible oil.
8. Draw the flow chart for the manufacturing of glycerin.
9. Visit at least two vegetable oil refinery factory and submit a report.

REFERENCE BOOKS

- | | | |
|----|--|--------------------------------------|
| 1 | Shreve's Chemical Process Industries | - George T. Austin |
| 2 | Dryden's Outlines of Chemical Technology | - M. Gopala Rao and Marshall Sitting |
| 3 | Industrial Chemistry (Vol & II) | - R.K. Das |
| 4 | Modern Applied Chemistry | - A.N. Zamre, V.G. Ratolikar |
| 5. | Industrial Chemistry | - B. K. Sharma |
| 6. | Fatty acids and products | - S B P Publication |

AIMS

- To provide understanding the basic theories of quantitative chemical analysis.
- To develop skill in quantitative chemical analysis.
- To develop skill in volumetric chemical analysis.
- To develop skill in preparation of standard solution.
- To develop skill in chemical analysis of water, oils, fats and soap .

SHORT DESCRIPTION

Introduction to quantitative analysis; Modern Concepts of acid and bases; Volumetric analysis, Hydrogen ion concentration and pH; Buffer Solution & Indicators; Law of mass action; Ionic Equilibria; Complex standard Solution; Chemical analysis of food; Gravimetric analysis; Hydrolysis of salts.

DETAILED DESCRIPTION**Theory:****1. Understand the fundamental concepts of quantitative analysis and laboratory rules.**

- 1.1 Define analysis.
- 1.2 List different types of analysis.
- 1.3 Describe different types of quantitative analysis.
- 1.4 Describe Laboratory rules and safety for analysis.
- 1.5 List the poisonous, highly flammable and highly corrosive chemicals used in the analytical laboratory.
- 1.6 Mention the first aid for the following laboratory accidents.
 - a) Minor cuts and injuries
 - b) Severe bleeding
 - c) Burns by steam, hot water and fire
 - d) Burns by acids and alkalis
 - e) Poison inhaling from gases (hydrogen sulphide, carbon mono-oxide, chlorine and bromine) and fumes.

2. Understand the Modern Concepts of acid and bases.

- 2.1 Define the terms acids and bases, according to the Bronsted protonic Concept.
- 2.2 Define the terms acids and bases, according to the Lewis Concept.
- 2.3 Define Conjugate acid and Conjugate base.
- 2.4 Explain the relative strength of acids and bases.
- 2.5 Explain the determination of strength of acids in terms of oxidation number.
- 2.6 Explain the order of increasing & decreasing acidity for each of the following series of acids.
 - a. HOCl, HOBr, HOI, HOF.
 - b. HCl, HBr, HI, HF.
 - c) HOC, HOCO, HOCO₂, HOCO₃.
- 2.7 Explain the classification of following substances as acids and bases giving reasons
BF₃, NH₃, NH₄⁺, Ag⁺, CaO, SO₃, KCN, OH⁻, H⁺, Na.

3. Understand the concept of Volumetric analysis

- 3.1 Identify different apparatus used in quantitative analysis.

- 3.2 Explain the terms: Acidimetry, Alkalimetry, Normal solution and Normality, Equivalent weight of an acid, Bases and salt, Equivalent weight of oxidizing and reducing agent. Titration, End point and Neutralization.
- 3.3 Explain the preparation of standard 0.1N Na_2CO_3 solution.
- 3.4 Explain the preparation of 0.1 N NaOH solution.
- 3.5 Explain the preparation of 0.1N H_2SO_4 solution.
- 3.6 Explain the standardization of 0.1N H_2SO_4 solution with standard NaOH solution.
- 3.7 Explain the preparation of 0.1N oxalic acid ($\text{C}_2\text{H}_2\text{O}_4 \cdot 2\text{H}_2\text{O}$) solution.
- 3.8 Explain the standardization of 0.1N NaOH solution with standard oxalic acid ($\text{C}_2\text{H}_2\text{O}_4 \cdot 2\text{H}_2\text{O}$) solution.

4. Understand the concept of hydrogen ion concentration and pH.

- 4.1 Explain the term hydrogen ion concentration.
- 4.2 Explain the pH of different types of solution.
- 4.3 Mention the mathematical expression of the term pH.
- 4.4 Explain the pH scale.
- 4.5 Explain "pH of pure water is 7".
- 4.6 Solve mathematical problems on pH.

5. Understand the concepts of buffer solution.

- 5.1 Define buffer solution.
- 5.2 State the characteristics of buffer solution.
- 5.3 Explain buffer capacity.
- 5.4 Explain the mechanism of buffer solution.
- 5.5 List the pH range of ten buffer solution.
- 5.6 Define indicators.
- 5.7 Explain different types of indicators.
- 5.8 Explain the action of acid-base indicators.
- 5.9 Explain the pH range and color of ten acid-base indicators.

6. Understand the Fundamental Concept of law of mass action.

- 6.1 Define reversible reaction.
- 6.2 Define chemical equilibrium.
- 6.3 List three Criteria of chemical equilibrium.
- 6.4 State the law of mass action
- 6.5 Mention the mathematical expression of equilibrium constant.
- 6.6 Mention the relation between K_p , K_c and K_x mathematically.
- 6.7 Solve problems of law of mass action.

7. Understand the concepts of ionic equilibria.

- 7.1 Explain the term ionization constant.
- 7.2 State the Ostwald's dilution law.
- 7.3 Express the deduction of the equation of Ostwald's dilution law.
- 7.4 Mention the limitations of Ostwald's dilution law.
- 7.5 Explain the meaning of the term "Common ion effect".
- 7.6 Explain the application of common ion effect in the field of analytical chemistry
- 7.7 Describe Ionic product of water.
- 7.8 Describe Ostwald's dilution law.
- 7.9 Solve the problem on Ostwald's dilution law.

8. Understand the preparation of complex standard solutions.

- 8.1 Explain the preparation of 0.1N KMnO_4 solution.
- 8.2 Explain the standardization of KMnO_4 solution.
- 8.3 Explain the preparation of 0.1N $\text{K}_2\text{Cr}_2\text{O}_7$ solution.
- 8.4 Explain the preparation of starch solution.
- 8.5 Explain the preparation of 0.1N thiosulphate solution.
- 8.6 Explain the standardization of 0.1N thiosulphate solution.

9. Understand the concept of chemical analysis of food.

- 9.1 Understand the analytical components of food.
- 9.2 Importance of determining the nutrient present in food.
- 9.3 Describe the method of determination of rancidity of fats and oils.
- 9.4 Describe the method of determination of free fatty acid in fats & oils.
- 9.5 Describe the volumetric method of fat determination in food.
- 9.6 Describe the method of determination of protein in food by the kjeldahl method.
- 9.7 Describe the method of determination of vitamin C in citrus fruits.
- 9.8 Describe the method of determination of calcium, phosphorus, copper, zinc and iron in foods.

10. Understand the fundamental concept of gravimetric analysis.

- 10.1 Define gravimetric analysis.
- 10.2 Explain the precipitation method of gravimetric separation of elements.
- 10.3 Explain the evolution method of gravimetric separation of elements.
- 10.4 Explain the electro-analytical method of gravimetric separation of elements.
- 10.5 Explain the mechanism of determination of iron as ferric oxide.
- 10.6 Mention the theory of determination of nickel as dimethylglyoxime.
- 10.7 Describe the gravimetric method of fat determination.
- 10.8 Describe the method of separation and estimation of copper and zinc from cuprous thio cyanate and zinc ammonium phosphate respectively.

11. Understand the hydrolysis of salt.

- 11.1 Define hydrolysis.
- 11.2 Explain the hydrolysis of salt.
- 11.3 Explain the hydrolysis of salt of strong acid and strong base.
- 11.4 Explain the hydrolysis of salt of weak acid and weak base.
- 11.5 Explain the hydrolysis of salt of strong acid and weak base.
- 11.6 Explain the hydrolysis of salt of weak acid and strong base.
- 11.7 Mention the hydrolysis constant.
- 11.8 Mention the degree of hydrolysis.

PRACTICAL:

- 1. Identify the apparatus and laboratory appliances for the purpose of quantitative analysis.
- 2. Prepare the standard 0.1N Na_2CO_3 solution.
- 3. Prepare the 0.1N NaOH solution and standardize.
- 4. Prepare the standard 0.1N oxalic acid solution.
- 5. Prepare the 0.1N H_2SO_4 solution and standardize.
- 6. Prepare the 0.1N HCl solution and standardize.
- 7. Prepare the 0.1N KMnO_4 solutions and standardize.
- 8. Determine the rancidity of fats and oils.
- 9. Determine the free fatty acid of oils and fats.

10. Determine of vitamin A,B ,C & D by the volumetric method.
11. Determine protein in food by the kjeldahl method.
12. Determine cholesterol of edible oil/butter

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1. Advanced Practical Chemistry, Vol I, II & III – B.S. Ball and A.N. Sharma
2. Advanced Experimental Chemistry– J.N. Curtoo and R. Kapoor
3. বৈশ্বেষিক রসায়ন– হাজারী
4. ব্যবহারিক অজৈব রসায়ন (স্নাতক) - নুরুল হক ও মহিরউদ্দিন

AIMS

- To provide knowledge and skill in the production efficiency, Work study, CPM-PERT, BEP, Lean-Six Sigma, Quality, Environment Management, CAD & CAM, NC & CNC.
- To develop knowledge and skill in the production efficiency, Work study, CPM-PERT, BEP, Lean-Six Sigma, Quality, Environment Management, CAD & CAM, NC & CNC.

SHORT DESCRIPTION

Industrial Engineering, Productivity, Work Study, Plant Location, Material Handling, New Product Design, CPM & PERT, Inventory, Cost Concept & BEP, Lean-Six Sigma, Quality Management, Environment Management and Advanced Manufacturing.

DETAILED DESCRIPTION**Theory:****1. Understand the concept of industrial Engineering**

- 1.1 State the meaning of industrial Engineering.
- 1.2 Mention the different activities of Industrial Engineering.
- 1.3 Describe the objectives of Industrial Engineering.

2. Understand the concept of Productivity

- 2.1 Define productivity.
- 2.2 Distinguish between Production and Productivity.
- 2.3 Explain productivity Measures.
- 2.4 Describe the Factors Influencing Productivity.
- 2.5 Explain the Productivity Improvement Techniques.
- 2.6 Solve problems on productivity.

3. Understand the concept of Work Study

- 3.1 State Work Study.
- 3.2 Define Method Study
 - 3.2.1 Describe the Objectives of Method Study.
 - 3.2.2 Mention the Steps involved in Method Study.
- 3.3 Define Work Measurement
 - 3.3.1 Describe the Objectives of work Measurement.
 - 3.3.2 Describe the Techniques of work Measurement.
 - i) Time Study Equipment's
 - ii) Performance Rating (PR)
 - iii) Allowances
 - iv) Computation of Standard Time
- 3.4 Solve problems on Work Study.

4. Understand the concept of Plant Location

- 4.1 State Plant Location.
- 4.2 Mention the need for Selecting a Suitable Location.
- 4.3 Describe the importance of Location.

4.4 Compare between Urban and Rural Locations.

4.5 Describe factors Influencing Plant Location.

5. Understand the concept of Material Handling

5.1 State Material Handling.

5.2 Mention the Objectives of Material Handling.

5.3 Explain the Principles of Material Handling'

5.4 Mention the selection of Material Handling Equipment's.

5.5 Describe the Types of Material Handling Equipment's

6. Understand the concept of New Product Design

6.1 State New Product Design.

6.2 Mention the Objectives of New Product Design.

6.3 Define the Product-Life-Cycle (PLC).

6.4 Explain the Product Policy of an Organization

7. Understand the concept of Project Scheduling with CPM & PERT

7.1 Define CPM and PERT.

7.2 Mention the Objectives of Network Analysis.

7.3 Describe the applications of Network Analysis

7.4 Explain the Critical Path Method (CPM)

7.5 Describe Program Evaluation and Review Techniques (PERT).

7.6 Solve problems on CPM and PERT.

8. Understand the concept of Inventory

8.1 Defines Meaning of Inventory and Inventory Control.

8.2 Mention the Types of Inventories

8.3 Explain reasons for keeping Inventories

8.4 Explain the objectives of Inventory Control

8.5 Explain Safety Stock.

8.6 Explain Economic Order Quantity (EOQ).

8.7 Solve problems on Economic Order Quantity (EOQ).

9. Understand the production Cost Concepts & Break-Even Analysis

9.1 State Meaning of Engineering Economy.

9.2 Explain the Costs of Production.

9.3 Describe the Cost Concept and Unit Cost.

9.4 Explain Classification of Costs.

9.5 Explain Break-Even Analysis.

9.6 Explain Depreciation Analysis

10. Understand the Lean-Six Sigma

10.1 State the Lean and Six Sigma.

10.2 Mention the Lean Tools and Techniques.

10.3 Explain the 5S Philosophy.

10.4 Explain the KAIZEN.

10.5 Describe the Overall Equipment Efficiency (OEE).

10.6 Mention the Major Losses.

10.7 Describe the Types of wastes.

10.8 Describe the Phases of Six-Sigma.

11. Understand the Quality Management

11.1 Define Meaning of Quality.

11.2 Explain the Quality Control (QC) and Quality Assurance (QA).

11.3 Distinguish Between QC and QA.

11.4 Explain Quality ISO certification, e.g.ISO9000.

11.5 Describe audit and certification.

12. Understand the Industrial Environment Management

12.1 Define Meaning of Environment and its Pollution's.

12.2 Describe Earth's Environment.

12.3 Explain the Air Pollution.

12.4 Describe Global Warming.

12.5 Explain the Water Pollution.

12.6 Describe the Environmental Rules in Bangladesh.

12.7 Explain Safety, Health and Environment (SHE).

12.8 Describe Effluent Treatment Plant (ETP).

13. Understand the Advanced Manufacturing Technologies and System

13.1 State the Computer Aided Design (CAD)

13.2 State the Computer Aided Manufacturing (CAM)

13.3 Explain the Numerical Control (NC) and Computer Numerical Control (CNC)

13.4 Describe Basic Concept on Robotics.

PRACTICAL:

1. Work St in an industry and compute standard time
2. Study and establish a new plant location.
3. Develop an equipment which used in Material Handling
4. Make a survey report to establish a new project
5. Calculate and find out a critical path by applying CPM
6. Applying 5S in office/Workshop/Store.
7. Calculate and draw VSM of any types of industries
8. Draw a Cause and Effect Diagram to find out a Root Cause of an Accident.
9. Draw a flow diagram on ETP.

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2. Quality Control and Management-Ahsan Akter Hasin
3. Industrial Environment Management-Ahsan Akter Hasin.
4. Fundamentals of Engineering Economics-CNAN S. PARK.
5. CAD/CAM-Chris Mcmanon and immie Browne.