

4-YEAR DIPLOMA-IN-ENGINEERING PROGRAM

FOOD TECHNOLOGY

**SYLLABUS
(COURSE STRUCTURE-2010)**

**FIFTH & SIXTH
SEMESTER**

FOOD TECHNOLOGY(69)

5th Semester

Sl. No	Subject code	Name of the subject	T P C			MARKS				
						Theory		Practical		Total
						Cont. assess	Final exam.	Cont. assess	Final exam.	
1.	6951	Food Preservation	2	6	4	20	80	50	50	200
2.	6952	Food Chemistry	2	3	3	20	80	25	25	150
3.	6953	Food Packaging	2	3	3	20	80	25	25	150
4.	6354	Industrial Chemistry	3	3	4	30	120	25	25	200
5.	7142	Engineering Mechanics	3	3	4	30	120	25	25	200
6.	6355	Refrigeration & Cold Storage	2	3	3	20	80	25	25	150
7.	5851	Book Keeping	2	0	2	20	80	-	-	100
Total			16	21	23	160	640	175	175	1150

FOOD TECHNOLOGY(69)

6th Semester

Sl. No	Subject code	Name of the subject	T P C			MARKS				
						Theory		Practical		Total
						Cont. assess	Final exam.	Cont. assess	Final exam.	
1.	6961	Food Engineering Operation-1	3	3	4	30	120	25	25	200
2.	6962	Food Process Industries-1	3	3	4	30	120	25	25	200
3.	6363	Industrial Instrumentation & Process Control	2	3	3	20	80	25	25	150
4.	6364	Industrial Stoichiometry and Thermodynamics	3	3	4	30	120	25	25	200
5.	6365	Instrumental Methods of Analysis	2	3	3	20	80	25	25	150
6.	5840	Environmental Management	2	0	2	20	80	-	-	100
7.	5852	Industrial Management	2	0	2	20	80	-	-	100
Total			17	15	22					1100

4-YEAR DIPLOMA-IN-ENGINEERING PROGRAM

FOOD TECHNOLOGY(69)

SYLLABUS
(COURSE STRUCTURE-2010)

FIFTH SEMESTER

AIMS

- To be able to understand the basic concepts of food preservation & methods of food preservation.
- To be able to understand the chemical reactions involved in food spoilage and food preservation.
- To be able to understand the preservation of food at low temperature, chilling, Freezing, pasteurizing, irradiation, drying, canning, pickling, curing, smoking, fermenting and storage of food grains.

SHORT DESCRIPTION

Basic concept of food preservation & methods of food preservation, Food spoilage, Food poisoning, Controlled atmospheric storage; Food storage at chilling temperature; Preservation of food by freezing method. Food preservation by canning; Preservation of concentrate food; Pickling; Curing and smoking of food; Food preservation by fermentation, Chemical additives; Storage of grains.

DETAIL DESCRIPTION**Theory:****1. Understand the basic concept of food preservation & methods of food preservation.**

- 1.1. Define food preservation.
- 1.2. Mention the necessity of food preservation.
- 1.3. List the important methods of food preservation.
- 1.4. Describe basic principles of food preservation.
- 1.5. Explain the present condition of preservation.

2. Understand the food spoilage & food poisoning.

- 2.1. Define food spoilage.
- 2.2. Explain causes of food spoilage.
- 2.3. Describe types of food spoilage.
- 2.4. Explain prevention of food spoilage.
- 2.5. Describe shelf life.
- 2.6. Define food poisoning.
- 2.7. Describe classification of poisoning.
- 2.8. Effects of food poisoning.
- 2.9. Explain food infection & food intoxication.

3. Understand principle of fresh food storage.

- 3.1. Define ideal food storage.
- 3.2. Describe storage of food at low-temperature.
- 3.3. Explain storage life of food.
- 3.4. Describe plant product storage.
- 3.5. Describe animal product storage.

4. Understand the controlled atmospheric storage of food.

- 4.1. Define controlled atmospheric storage (CAS).
- 4.2. Describe principle of controlled atmospheric storage of food.
- 4.3. Explain classification of fruit on the basis of respiration.
- 4.4. Describe controlled atmospheric storage.
- 4.5. Mention the advantage of controlled atmospheric storage.

5. Understand preservation of food by refrigeration or cold storage & freezing method.

- 5.1. Define cold storage & freezing point of food.
- 5.2. Define refrigeration & freezing
- 5.3. Describe pre-cooling of the commodity.
- 5.4. Explain post warming.
- 5.5. Describe chilling injury.
- 5.6. Explain storage of food in cold storage.
- 5.7. Explain ammonia refrigeration system.
- 5.8. Mention different types of freezing methods.
- 5.9. Explain de-hydro freezing mentioning its advantages and disadvantages.
- 5.10. Describe freezer burn and thawing.
- 5.11. Describe changes occur during storage of food at freezing temperature.

6. Understand preservation of milk by pasteurization.

- 6.1. Define pasteurization, Sterilization and Homogenization.
- 6.2. Describe the methods of pasteurization.
- 6.3. Explain holding system of pasteurization.
- 6.4. Explain HTST, LTLT, & UHT pasteurization of milk.
- 6.5. Describe sterilization of milk.
- 6.6. Explain methylene blue reduction test & adulteration test.

7. Understand the production and preservation of different type of fruits pulp.

- 7.1 Define the term of pulp & juice.
- 7.2. Mention different types of fruits & vegetables pulp.
- 7.3. Describe different pulp production processes .
- 7.4. Describe manufacturing process of mango pulp, pine apple pulp, guava pulp.
- 7.5. Describe different pulp storage.

8. Understand the preservation of food by drying.

- 8.1. Define drying & dehydration
- 8.2 Explain mode of action of drying.
- 8.3. Name different types or dryer used in food processing industries
- 8.4. Mention the advantages & disadvantages of drying food.
- 8.5. Differentiate between drying and dehydration.
- 8.6. Define Case hardening & prevention of case hardening.

9. Understand the food preservation by canning.

- 9.1. Define canning.
- 9.2. Mention the factors effecting the thermal resistance of micro organisms.
- 9.3. Describe pre-processing operations of canning.
- 9.4. Describe retorting of can products.
- 9.5. Describe heat processing of cans in a batch sterilizer.
- 9.6. Describe labeling and storage of cans.

10. Understand the food preservation by concentration

- 10.1. Define high acid high solid foods
- 10.2 .Mention the principle of food preservation by concentration
- 10.3 Describe mode of action of some chemicals for jell formation e.g. CMC, Agar, Starch powder
- 10.4 Describe pectin and proto-pectin
- 10.5 State the classification of fruits on the basis of pectin

11. Understand the pickling.

- 11.1. Define pickling
- 11.2. Explain preservative action of salt and sugar.
- 11.3. Describe methods of food preservation by brining and Leaching.

- 11.4. Describe the preparation of cucumber pickle.
- 11.5. Explain vinegar pickle.
- 11.6. Describe preservation of fish with salt.

12. Understand the food preservation by fermentation.

- 12.1. Define fermentation and putrefaction.
- 12.2. List the advantage of fermentation.
- 12.3. Distinguish between fermentation and putrefaction.
- 12.4. Mention the desirable characteristics of micro-organisms used in fermentation.
- 12.5. List the different types of fermentations.

13. Understand food additives.

- 13.1. Define food additives.
- 13.2. Describe GRAS.
- 13.3. Define E numbers
- 13.4. List different types of food additive.
- 13.5. Explain different types of food additives.
- 13.6. State the purpose for use of food additives
- 13.7. Describe adulteration of food.
- 13.8. List the adulterant uses in different foods.
- 13.9 Explain benzoic acid, sorbet, sodium benzoate, sulphur di-oxide, chlorine, KMS, sugar and salt ,EDTA, Formaldehyde.

14. Understand the storage of grains.

- 14.1. Define bulk storage of food
- 14.2. Describe physical chemical and biological aspects of storage of grains.
- 14.3. Describe the properties of a modern storage structure.
- 14.4. Mention the causes of damaging of grains during storage.
- 14.5. Describe the damages of grain due to insects infestation and rodents.
- 14.6. Explain the method of controlling damage of grains.

PRACTICAL

1. Determination of acidity in any of citrus fruit juice
2. Preserve carrot or ladyfinger in Brine solution.
3. Prepare spicy vinegar.
4. Preserve tomato juice for future use.
5. Prepare tomato pure and preserve in a clean and sterilize glass bottle.
6. Prepare mixed fruit jam.
7. Prepare Orange nectar.
8. Prepare Orange squash.
9. Prepare Orange marmalade.
10. Prepare mango pickle from green mango.
11. Prepare pine apple jam.
12. Prepare mango squash after analysis of pulp and calculation of recipe.
13. Dry the ginger slice in a dryer and preserve in a container.
14. Dry the sliced onion in a dryer and preserve for future use.
15. Prepare pineapple pulp and preserve in tin coated can.
16. Prepare mango and jackfruits pulp and preserve in tin coated can.
17. Cottage Cheese preparation from fresh milk
18. Preparation of sour and sweet yoghurt (Curd) from fresh milk
19. Prepare garlic and onion pickle from green olive and garlic
20. Prepare hot and sweet mango chutney from green mango
21. Prepare jackfruit chutney from un-ripen jackfruit
22. Prepare mango nectar by using mixture blender, gas burnet and hand refractometer

23. Dry potato slice in a solar drier and preserve in a plastic film
24. Prepare pellets of chips for future of use of chip products
25. Prepare mango jam after analysis of pulp and calculation of recipe

REFERENCE BOOKS

1. খাদ্য সংরক্ষণ - মোঃ আবু আবদুল্লাহ
2. The Technology of Food Preservation – Norman w. Desroiser.
3. Processing of Fruits, Vegetables and other Food products – SBP Boards of Consultants and Engineers.
4. Food Processing plants Vol. I & II – Slade.
5. Food science and Technology – Mangus Pyke.
6. Physical Principles of Food Preservation – Marcus Karel, Owen R Kennema, Daryl B. Lund.
7. Food science: N.H. Potter
8. Food Processing and Preservation: Siva-sankar
9. খাদ্য প্রক্রিয়াজাতকরণ: মোঃ আব্দুর রাজ্জাক

6952	FOOD CHEMISTRY	T	P	C
		2	3	3

AIMS

- To be able to understand the basic concept of food chemistry.
- To be able to understand carbohydrates, proteins, Lipids, Minerals, vitamins, Enzymes, water activity and fortification of foods.
- To be able to perform experiments in food analysis

SHORT DESCRIPTION

Physico chemical properties of foods; water and water activity; Lipids; carbohydrates; proteins; Browning; vitamins Minerals; Hydrogen Ion concentration; Fortification of foods; Pigments used in foods; enzymes used in foods.

DETAIL DESCRIPTION

Theory:

1 Physico chemical properties of foods.

- 1.1 State the meaning of colloids.
- 1.2 Classification of colloids.
- 1.3 List the properties of colloidal solutions.
- 1.4 Difference between colloid and crystalloid.
- 1.5 Describe osmotic pressure, diffusion, hypotonic, hypertonic and isotonic pressure.
- 1.6 Mention the application of osmosis of food processing..

2 CARBOHYDRATES

- 2.1 Define carbohydrates and glycoside bond (α -1,4).
- 2.2 Classification of carbohydrates
- 2.3 State the meaning of mutarotation, isomerization, asymmetric carbon, Polymerization, caramelization and plane polarized Light
- 2.4 Chemical structures of glucose, fructose, cellulose, starch, amylose, glycogen, sucrose, lactose and maltose.
- 2.5 List the properties and uses of gum arabic, guar gum, agar, Starch powder and CMC.
- 2.6 Define Starch, amylose, and invert sugar.
- 2.7 Define the manufacturing process of glucose from starch with chemical reactions.
- 2.8 Describe Reducing and Non- Reducing sugar.

3 Lipids.

- 3.1 Define lipids and fatty acids.
- 3.2 Mention the constituent of lipids physical and chemical properties of lipids
- 3.3 Sources of Saturated and unsaturated fatty acid.
- 3.4 Mention essential and Non-essential fatty acid
- 3.5 List 5 saturated, 5 unsaturated and 5 essential fatty acids.
- 3.6 Define rancidity of lipids and classify rancidity.
- 3.7 Mention the effects of oxidative and hydrolytic rancidity.
- 3.8 State the meaning of the terms acid value, peroxide value, saponification value of fats and oils.
- 3.9 Determination of acid value, peroxide value, I₂ value and saponification value.
- 3.10 Define hydrogenation and explain the hydrogenation of fats and oils.

4 PROTEINS

- 4.1 Define proteins.
- 4.2 Classification of proteins
- 4.3 Define simple proteins, conjugation proteins, derived proteins and peptide bond
- 4.4 Explain the denaturation of proteins.
- 4.5 Mention the amino acid composition of proteins

- 4.6 Mention the chemical structure of essential Non- essential and semi- essential amino acids.
- 4.7 Mention the milk proteins, egg proteins, wheat and soyabean proteins.
- 4.8 Difference between essential and limiting amino acids.

5. VITAMINS AND MINERALS

- 5.1 Define vitamins and minerals
- 5.2 List major minerals in foods.
- 5.3 State trace elements in food.
- 5.4 Mention the importance of Calcium, Magnesium, Sodium, Potassium, Iron, Iodine.
- 5.5 Classify of vitamin.
- 5.6 Chemical name of vitamins.
- 5.7 Mention the chemical structure of Vitamin A, D, E, C, Thiamine, Riboflavin, Nicotinamide, Pyridoxine, folic acid.

6 WATER & WATER ACTIVITY.

- 6.1 Define water activity.
- 6.2 List the types of water in foods.
- 6.3 State the structure of water molecule.
- 6.4 Describe sorption phenomena.
- 6.5 Mention the triple point of water.
- 6.6 State the role of triple point of water in freeze drying
- 6.7 Explain the role of water activity in food spoilage.
- 6.8 Explain the water activity in food packaging.
- 6.9 Physical, chemical, Biological characteristics of water.
- 6.10 Mode of action of water activity (a_w).

7 Fortification of Foods.

- 7.1 Define Fortification of Foods.
- 7.2 Mention the fortification tools or criteria.
- 7.3 Mention the objects of enrichment and fortification of foods.
- 7.4 Describe the fortification of cereals and cereals products with vitamin and minerals.
- 7.5 Describe the fortification of Dairy products.
- 7.6 Describe the fortification of fruits and sugar products.
- 7.7 Describe the Iodization of Salt.
- 7.8 Discuss the fortification of special dietary foods (infants).

8. Hydrogen Ion Concentration (PH)

- 8.1 Define P^H .
- 8.2 Describe ionization of water.
- 8.3 Explain pH Scale.
- 8.4 Define buffer Solution
- 8.5 Explain mechanism of buffer Solution.
- 8.6 Mention the Acidic and Basic buffer.
- 8.7 List of buffer Solutions.

9. BROWNING

- 9.1 Define browning and classification of browning.
- 9.2 Define Maillard reactions.
- 9.3 Explain the mechanism of Maillard reactions.
- 9.4 Mention the beneficial and non-beneficial effects of Maillard reaction on processed food.
- 9.5 Explain the prevention methods of enzymatic and non-enzymatic browning.

10. ENZYMES

- 10.1 Define enzymes.

- 10.2 List the name of enzymes used in the processing of different types of foods.
- 10.3 Mention the nomenclature of enzymes.
- 10.4 Describe the Mode of action of enzymes.
- 10.5 Explain the factors of enzyme activity.
- 10.6 Mention the activities of Amylases, Proteases, Pectinases, Catalase, Peroxides.

11. PIGMENTS.

- 11.1 Define pigments.
- 11.2 List the group of pigments.
- 11.3 Describe the properties and changes of chlorophyll in food processing.
- 11.4 Describe the properties of carotenoids used in food.
- 11.5 Describe the name of flavanoids and other pigments used in food.
- 11.6 List the name of flavanoids.

Practical :

- 1 Determine the moisture in foods by oven drying methods.
- 2 Determine the percentage of acidity of supplied sample
- 3 Determine the amount of fat present in a given sample of milk by garber method
- 4 Determine the percentage of carbohydrates present in foods
- 5 Determine the percentage of minerals present in food.
- 6 Determine the hardness of tap water.
- 7 Determine the enzyme activities in fruits, vegetables and milk qualitatively.
- 8 Determine the Iodine value of a given sample.
- 9 Determine saponification value of supplied sample.
- 10 Determine the TDS of supplied sample.
- 11 Determine the percentage of proteins of supplied sample by kjeldhal method .present
- 12 Determine the presence of Vitamins C in food sample.

REFERENCE BOOKS

1. **Principles of Food Chemistry**
- by John M. Deman
2. **Introductory Food Chemistry**
- by Garand I. D.
3. **Food Science, Chemistry and Experimental Foods**
- by Swaminathan M.
4. **Food Chemistry**
- by Fennema O. R.
5. **Food Chemistry**
- by Mayer L. H.
6. **Introduction to Carbohydrate Chemistry**
- by Guthrie R. D
7. **Applied Protein Chemistry -** by Grant R. A
8. **Chemical Analysis of Food**
- by JACOB.
- RANGAMA.

7 **Biochemistry -** by Dr. U. SATYAHARAYANA.

6953 FOOD PACKAGING	T	P	C
	2	3	3

AIMS:

- To be able to understand basic concepts of food packaging.
- To be able to understand the various forms of packaging materials in common use.
- To be able to understand packaging preparation procedure.
- To be able to understand design of packaging.
- To be able to understand the principles and processes involved in aseptic packaging.
- To be able to understand MAP.
- To be able to understand printing and labeling.

SHORT DESCRIPTION

Basic concept of Packaging, Packaging materials and equipments, test methods of papers, foils and films, flexible packaging materials, thermoplastic polymers, container, glass bottle, glass container, metal packaging, traditional food packaging, aseptic packaging of food, MAP, packaging of fresh food and processed food, measurement of packaging, printing and labeling.

DETAIL DESCRIPTION

Theory:

- 1. Understand basic concept of packaging.**
 - 1.1 History of food packaging.
 - 1.2 Define packaging and food packaging.
 - 1.3 Mention purpose of packaging.
 - 1.4 Describe the packaging criteria.
 - 1.5 Functions of packaging.
 - 1.6 Environments of packaging.
 - 1.7 Describe factors influencing design/selection of packaging.
- 2. Understand packaging materials and equipments.**
 - 2.1 List important packaging materials and equipments.
 - 2.2 List blending, sieving and bagging materials and equipments.
 - 2.3 Explain food grade packaging materials.
 - 2.4 Define paper, plastic, glass and container.
 - 2.5 Describe improved paper.
 - 2.6 Describe wet strength paper.
 - 2.7 Describe basis box.
 - 2.8 Describe shrink wrapping.
 - 2.9 Characteristics and uses of packaging materials.
- 3. Understand form, fill and seal process.**
 - 3.1 Describe form, fill and seal process.
 - 3.2 List form, fill and seal process materials.
 - 3.3 List form, fill and seal process equipments.
 - 3.4 Preparation of form, fill and seal process.
 - 3.5 Describe making a carton or box.
- 4. Understand test methods of papers, foils and films.**
 - 4.1 Describe basis weight and thickness of paper, films and foils.
 - 4.2 Explain tensile strength.
 - 4.3 Explain tear strength.
 - 4.4 Explain bursting strength.
 - 4.5 Explain rigidity, stiffness and softness.

- 4.6 Explain water proofness measure of pH.
- 5. Understand Flexible packaging materials.**
 - 5.1 Define flexible packaging.
 - 5.2 List of flexible packaging materials.
 - 5.3 Describe properties of flexible packaging materials.
 - 5.4 List the package made from the flexible package materials.
 - 5.5 Define plastic film, pigmented film and aluminum foil.
 - 5.6 Describe characteristics of laminated film.
- 6. Understand processing and converting of thermoplastic polymers.**
 - 6.1 Define polymer.
 - 6.2 Describe extrusion, calendaring, coating and laminating.
 - 6.3 Describe metallization and micro perforation.
 - 6.4 Describe injection molding.
 - 6.5 Describe blow molding.
 - 6.6 Describe thermoforming.
 - 6.7 Describe foamed (cellular) plastics.
- 7. Understand Container.**
 - 7.1 Define container.
 - 7.2 Mention classification of container.
 - 7.3 Describe advantages and disadvantage of tin container.
 - 7.4 Describe advantages and disadvantage of aluminum container.
 - 7.5 Describe advantages and disadvantage of glass container.
 - 7.6 Describe advantages and disadvantage of plastic container.
- 8. Understand glass, glass bottle and glass container.**
 - 8.1 Define glass.
 - 8.2 List raw materials for the preparation of glass and with composition.
 - 8.3 Draw a flow sheet for preparation of glass bottle and glass container.
 - 8.4 Indicate different parts of glass bottle and glass container.
 - 8.5 List different types of glass bottle cork.
 - 8.6 Describe closures and sealing for glass containers.
 - 8.7 Describe failure of glass bottle.
- 9. Understand Metal packaging.**
 - 9.1 Describe manufacturing of tinplate.
 - 9.2 Describe manufacturing of steel base plate.
 - 9.3 Describe manufacturing of Aluminum.
 - 9.4 Describe Container making process.
 - 9.5 Corrosion of metal packaging materials.
 - 9.6 Describe different type of lacquers and their uses.
 - 9.7 Identification of different parts of cans.
 - 9.8 Describe can making with flow sheet.
 - 9.9 Describe critical parameters of seam.
- 10. Understand traditional food packaging.**
 - 10.1 Describe traditional food packaging technologies.
 - 10.2 Describe food preservation principles and their integration with food packaging.
 - 10.3 Describe the influence of packaging on biochemical and microbiological changes in food.
 - 10.4 Describe the influence of packaging on physical and chemical changes in food.
 - 10.5 Describe the influence of packaging on flavor, colour, texture, moisture and oxygen transfer in food.

- 10.6 Describe the influence packaging on the resistance of a food product to temperature changes and light damage.
- 11. Shelf life and Aseptic packaging of food.**
- 11.1 Define shelf life and Aseptic packaging of food.
 - 11.2 Factors controlling shelf life.
 - 11.3 List of shelf life devices.
 - 11.4 Sterilization of packaging material food contact surfaces.
 - 11.5 Aseptic packaging system.
 - 11.6 Define tetrapak and composition of tetrapak.
 - 11.7 Describe aseptic tetrapak manufacturing process.
 - 11.8 Designing of process for aseptic packaging of particulate foods.
 - 11.9 Describe the depending factors of sterilization efficiency of aseptic packaged food
- 12. Understand modified atmosphere packaging (MAP).**
- 12.1 Define modified atmosphere packaging.
 - 12.2 Principles of modified atmosphere packaging.
 - 12.3 Gases use in modified atmosphere packaging.
 - 12.4 Methods of creating modified atmosphere packaging condition.
 - 12.5 Equipments for modified atmosphere packaging.
 - 12.6 Packaging for modified atmosphere packaging application.
 - 12.7 Safety of modified atmosphere packaging.
- 13. Understand packaging of flesh food, horticultural, dairy and processed food products.**
- 13.1 Describe packaging of flesh foods.
 - 13.2 Describe packaging of Horticultural products.
 - 13.3 Describe packaging of milk and milk products.
 - 13.4 Describe packaging of bakery products.
 - 13.5 Describe packaging of snack products.
 - 13.6 Describe packaging of confectionery products.
 - 13.7 Describe packaging of beverages.
- 14. Understand measurement of packaging.**
- 14.1 Define Gram per square meter (GSM).
 - 14.2 GMS measurement of packaging materials.
 - 14.3 Measure the standard size, thickness, weight of 1 liter PET bottle.
 - 14.4 Show the standard measuring system of a PET foil.
 - 14.5 Calculate the length of holding tube (L) of a laminar flow.
 - 14.6 Calculate mean residence time(t_m).
- 15. Understand package printing process, Inks, adhesive and labeling of packaging materials.**
- 15.1 Define packaging printing and labeling.
 - 15.2 Describe briefly main printing process.
 - 15.3 Describe factors affecting the choice of a printing process.
 - 15.4 Describe Inks and adhesive.
 - 15.5 Describe purpose of labels.
 - 15.6 Describe types of labels.
 - 15.7 List of materials used for labels.
 - 15.8 Describe marking and bar coding.

PRACTICAL:

1. Identify different types of Packaging materials.

2. Operate a sealing machine and sealing food products.
3. Operate a form, fill and seal machine and making a carton or box.
4. Perform tensile strength and tear strength of packaging materials.
5. Perform busting strength of packaging materials.
6. Perform thickness of PET bottle.
7. Perform leak of foil pack.
8. Perform dried food storing by bags.
9. Measure the standard size, thickness, weight of 1 litter PET bottle.
10. Perform preserve vegetable by canning.
11. Perform spoilage examination of canned food.
12. Visit food packaging industry and submit visit report.

REFERENCE BOOKS

1. Fundamentals of packaging, Editor- F.A. PAINE.
2. Food Packaging: Principles and Practice, By- Gordon L. Robertson. Marcel Dekker. 1993
3. Hand book of packaging technology, By- NIIR Board of consultants and Engineers India Research Institute.
4. Processing of Fruits, Vegetables and other food products, By- SBP Board of Consultants and Engineers.
5. Principle of Food Packaging, By- R. Heiss.

T	P	C
3	3	4

AIMS:

- To be able to understand the concept of inorganic and industrial chemistry (organic)
- To be able to develop skill in analyzing chemical compounds. (inorganic and organic compounds)
- To be able to develop skill in studies bio molecular chemistry.
- To be able to develop knowledge in industrial raw materials of ceramics.

SHORT DESCRIPTION:

Significance atoms and ions; Significance quantum number; acid and bases; chemical reaction, oxidational reductions. Classification of organic compounds; saturated and unsaturated hydrocarbons; Alcohols; Fatty acids and carbohydrates; polycyclic hydrocarbons and their derivatives; Bio molecular chemistry.

Theory:**Size of atoms and ions****1. Understand the size of atoms and ions.**

- 1.1 Describe the valency and ionic bonds.
- 1.2 State the meaning of variable ionic bond.
- 1.3 Explain atomic and ionic radius.
- 1.4 Explain Vanderwaal's radius.
- 1.5 Explain the terms:
 - a) Polarization of ions.
 - b) Bond length
 - c) Election affinity
 - d) Bond angle
 - e) Bond energy
 - f) Dipole movement

Significance of quantum number**2. Understand the aspects of quantum numbers.**

- 2.1 Explain quantum number.
- 2.2 Name the four quantum number and significance of quantum number.
- 2.3 Explain energy levels, shells and sub-shells.
- 2.4 Explain difference between an orbit and orbital.
- 2.5 Explain the terms:
 - a) Atomic number
 - b) Gram atom
 - c) Molecular mass number

- d) Atomic mass number
- 2.6 Show the distribution of electrons:- Li(2), Be(4), N(7), Ne(10), Na(11), Cl(17), K(19) and Ca(20)

Acid and Bases

- 3. Understand the modern concepts of acids & bases.**
- 3.1 Explain the modern concepts of acids and bases.
 - 3.2 List the some important acids and bases.
 - 3.3 Explain the Bronsted theory of acids and bases with example.
 - 3.4 Explain the Lewi's theory of acids and bases with example.
 - 3.5 Explain the method of determination of relative strength of acids and bases.
 - 3.6 "H₂SO₄" is stronger than "H₃SO₄"! Explain it.
 - 3.7 State the classification of the following substance as acids and bases:
NH₃, NH₄, OH, HCl, Ken, SO₃⁻², CO₃, CO₂, NaOH, NaO and Cl₂

Chemical reaction, oxidation and reduction

- 4. Understand the feature of chemical reaction, oxidation and reduction.**
- 4.1 Explain chemical reaction.
 - 4.2 Explain the different types of chemical reaction.
 - 4.3 State oxidation and reduction.
 - 4.4 Explain exothermic and endothermic reaction.
 - 4.5 Explain the simultaneous, dissociation, thermal dissociation and ionic reaction.
 - 4.6 Describe oxidation and reduction numbers.

Preparation of a few inorganic compounds.

- 5. Understand the manufacturing process & inorganic compounds.**
- 5.1 Describe the preparation of CuCl (Cuppers chloride) solution.
 - 5.2 Explain the preparation of Na₂S₂O₃, SH₂O (sodium thio sulphate).
 - 5.3 Explain the preparation of K₂ SO₄, Al₂ (SO₄), H₂O (potas alum)
 - 5.4 Explain the preparation FeSO₄, (NH₄)₂ SO₄, 6H₂O (Ferus amonium sulphate)

History of organic compounds and importance of organic compounds.

- 6. Understand the future of organic compounds.**
- 6.1 State the meaning of organic compounds.
 - 6.2 Explain the classification of organic compounds.
 - 6.3 Explain the homologous series of organic compounds.
 - 6.4 State alkanes, alkenes and alkynes.
 - 6.5 Explain the functional group of organic compounds.
 - 6.6 Mention the IUPAC system of nomenclature of organic compounds.

Isolation and purification of organic compounds.

- 7. Understand the modern concepts purification of organic compounds.**
- 7.1 Explain the purification methods of organic compounds.
 - 7.2 Explain the crystalization methods for purification of organic compounds.
 - 7.3 Explain the distillation methods for purification of organic compounds.

- 7.4 Describe the fractional distillation methods for purification of organic compounds.
- 7.5 Explain the steam distillation methods for purification of organic compounds.
- 7.6 Describe solvent extraction methods for purification of organic compounds.
- 7.7 Explain the chromatographic methods for separation of organic compounds.
- 7.8 State the purification valuation of liquid organic compounds.

Qualitative and quantitative analysis of organic compounds.

- 8. **Understand the modern concept of qualitative and quantitative analysis of organic compounds.**
 - 8.1 Explain the identification of carbon (C) and hydrogen (H) in organic compounds.
 - 8.2 Explain the identification of nitrogen (N), halogen (He) by lassaigne test.
 - 8.3 Describe the meaning process of nitrogen in hydrocarbon by Duma's methods.
 - 8.4 Explain the meaning process of carbon and hydrogen in organic compounds using carbon and hydrogen measuring equipment.
 - 8.5 Explain the fusion method to determined nitrogen and sulpher in organic compounds

Oxidation and reduction titrations involving iodine iodimetry and iodometry.

- 9. **Understand the modern concept of oxidation and reduction titration of iodimetry.**
 - 9.1 Describe titration.
 - 9.2 Explain indicators and write the name of ten chemicals indicators.
 - 9.3 Explain iodimetry and iodometry.
 - 9.4 Explain the manufacturing process of starch solution.
 - 9.5 Standardization of thiosulphate solution by standard $K_2Cr_2O_7$ solution by idiomatic methods
 - 9.6 Explain preparation procedure of standard $\frac{N}{10}$ iodine solution.
 - 9.7 Explain titration procedure of $\frac{N}{10}$ Na_2CO_3 by HCl solution.

Aliphatic hydrocarbon/Saturated hydrocarbon.

- 10. **Understand the feature of Saturated hydrocarbon.**
 - 10.1 Explain the meaning of hydrocarbon, saturated hydrocarbon and unsaturated hydrocarbon.
 - 10.2 Describe the physical properties of saturated hydrocarbon.
 - 10.3 Explain chemical reaction of alkenes.
 - 10.4 Explain the uses of alkene.
 - 10.5 List ten chemical equation of paraffin (alkenes).
 - 10.6 Explain octane number and knocking.
 - 10.7 Explain the methods of increasing octane number and reducing knocking.

Unsaturated hydrocarbon.

- 11. **Understand the feature of unsaturated hydrocarbon.**
 - 11.1 State the meaning of alkenes and alkynes.
 - 11.2 Explain the physical and chemical properties of ethylene.
 - 11.3 Explain the preparation of acetylene.
 - 11.4 List the uses of acetylene.

- 11.5 List the uses of methyl iodide, ethyl iodide, chloroform and grignard reagent.
- 11.6 Explain the preparation procedure of chloroform ethylealchole.

Polycyclic hydrocarbon and heterocyclic compound

12 Understand the feature of polycyclic and heterocyclic hydrocarbon.

- 12.1 Write the structural formula of diphenyl and naphthalene.
- 12.2 Mention the uses of diphenyl and naphthalene
- 12.3 Give the structural formula of furan, thiophene, thiozole, furfural and nicotinic acid.
- 12.4 Mention the uses of furan, thiophene pyridine and nicotinic acid.
- 12.5 List properties of furan, thiophene, pyrol, pyridine, furfural and nicotinic acid.

Alcohols

13. Understand the feature of alcohols.

- 13.1 State the meaning of alcohols.
- 13.2 Explain the functional group of alcohols.
- 13.3 Mention the classification of alcohols.
- 13.4 Mention the structure formula of four alcohols.
- 13.5 Explain the primary, secondary and tertiary alcohols.
- 13.6 Explain the manufacturing of ethyle alcohols.
- 13.7 Explain the manufacturing process of ethyle alcohols from starch by fermentation.
- 13.8 Explain the uses of molasses.
- 13.9 Explain following terms:
 - a) Fermentation.
 - b) Methylated sprit.
 - c) Power alcohol.
 - d) Enzyme.
 - e) Saponification.
- 13.10 Uses of alcohols.

Fatty acids and their derivatives.

14. Understand the feature of fatty acids.

- 14.1 State the meaning of the term carboxylic acid or fatty acid.
- 14.2 List the derivatives of fatty acid.
- 14.3 Mention the structural formula of three derivatives of fatty acid.
- 14.4 Mention the reason for carboxylic acid being called fatty acid.
- 14.5 Mention the chemical formula of five fatty acids.
- 14.6 Explain the preparation of formic acid.
- 14.7 Write the properties of formic acid.
- 14.8 Write the uses of formic acid.

15. Understand the feature of acetic acid.

- 15.1 Explain the industrial manufacturing of acetic acid.
- 15.2 Mention the physical and chemical properties of acetic acid.
- 15.3 Write the uses of acetic acid.
- 15.4 Explain the preparation of ethyl acetate.

- 15.5 Mention the properties of ethyl acetate.
- 15.6 Write the uses of ethyl acetate.

Hydroxy acid

16. Understand the fundamentals of hydroxy acids.

- 16.1 Explain the hydroxy acids.
- 16.2 Give the examples of three hydroxy acids.
- 16.3 Explain the preparation of lactic acids.
- 16.4 Write the physical properties of lactic acids.
- 16.5 Mention the uses of lactic acids.
- 16.6 Explain the manufacturing of citric acids.
- 16.7 Write the physical properties of citric acids.
- 16.8 Mention the uses of citric acids.

Carbohydrates.

17. Understand the feature of carbohydrates.

- 17.1 Explain the term carbohydrates.
- 17.2 Write the classification of carbohydrates.
- 17.3 List the example of carbohydrates
- 17.4 Explain the preparation of glucose.
- 17.5 Write the physical properties of glucose.
- 17.6 List the uses of glucose.
- 17.7 State the meaning of sucrose.
- 17.8 Mention the properties of sucrose.

Aromatic compounds.

18. Understand the feature of Aromatic compounds.

- 18.1 State the meaning of aromatic compounds.
- 18.2 List the important aromatic compounds.
- 18.3 Explain the preparation of benzene.
- 18.4 Write the uses of benzene.
- 18.5 Explain the preparation of benzene.
- 18.6 Write the uses of toluene.
- 18.7 Explain the preparation of 2-4-6 Tri-nitro toluene (TNT).
- 18.8 Mention the physical properties of TNT.
- 18.9 Write the uses of TNT(Tri-nitro toluene)

Chloro benzene

19. Understand the feature of chloro benzene, DDT and nitro benzene.

- 19.1 Write the structure formula of chloro benzene and DDT (DDT= Di-chloro di-phenyl tri-chloro ethane)
- 19.2 Explain the preparation of chloro benzene.
- 19.3 Mention the physical and chemical properties chloro benzene and di-chloro di-phenyl tri-chloro ethane.
- 19.4 Write the uses of chloro benzene and and di-chloro di-phenyl tri-chloro ethane.
- 19.5 Write the uses of nitrobenzene.

Aldehydes and ketons

20. Understand the aldehydes and ketons.

- 20.1 State the meaning of aldehydes and ketons.
- 20.2 Explain the carbonyl group.
- 20.3 Mention the structure of functional groups of aldehydes and ketons.
- 20.4 Mention the chemical formula of five aldehydes and ketons.
- 20.5 Mention the properties of aldehydes and ketons.
- 20.6 Mention the uses of aldehydes and ketons.

Formaldehydes

21. Understand the feature of formaldehyde.

- 21.1 Explain the preparation of formaldehyde.
- 21.2 Write the properties of formaldehyde.
- 21.3 Mention the physical and chemical properties of formaldehyde.
- 21.4 Mention the important list of formaldehyde.
- 21.5 Write the uses of formaldehyde.
- 21.6 State the meaning of formalin.
- 21.7 List the uses of formalin.

Bio-Molecular chemistry.

22. Understand the feature of bio-molecular chemistry.

- 22.1 Describe the function of carbohydrate.
- 22.2 Explain isomerism and optical isomer.
- 22.3 Explain pyranose, furanose, α - β anomer and epimer.
- 22.4 State reducing and non-reducing sugar.
- 22.5 Describe starch, amylose and amylo-pectin.
- 22.6 Explain cellulose and uses of cellulose.
- 22.7 Explain protein and composition of protein.
- 22.8 Describe the classification of protein.
- 22.9 Explain enzyme and enzyme inhibitor.
- 22.10 Describe nucleic acid and classification of nucleic acid (DNA/RNA)

Industrial raw materials for ceramics products.

23. Understand the feature of raw materials of ceramics.

- 23.1 State the meaning of clay.
- 23.2 List the classification of clay.
- 23.3 Explain residual and sedimentary clays.
- 23.4 Define china clay.
- 23.5 Define fire clay.
- 23.6 Explain talc.
- 23.7 Define feldspars.

PRACTICAL:

* Identify and preparation of acid and base solution.

1. Perform the litmas paper test for the supplied free acid sample.

2. Preparation of $\frac{N}{10}$ HCl solution.
3. Preparation of $\frac{N}{10}$ Na₂CO₃ solution.
4. Standardization of HCl solution by $\frac{N}{10}$ Na₂CO₃ solution.
5. Standardization of sodium thiosulphate solution with $\frac{N}{10}$ iodine solution by iodimetric method.

* Quantitative analysis of organic compounds.

6. Detect the presence of nitrogen in supplied organic sample.
7. To measure the nitrogen presence of hydrocarbon by Duma's method.
8. To detect the presence of carbon inorganic compounds.
9. Separation the organic compounds by steam distillation method.
10. Identify and unknown organic substances following physical characteristics of the supplied unknown organic compounds.
 - a) Color
 - b) Crystalline.
 - c) Solubility
11. Perform the following test of the supplied unknown solid/syrup residue-
 - a) Heated in a dry test tube.
 - b) Heated with soda-line
 - c) Heated with concentrate H₂SO₄
 - d) Warmed with Na₂CO₃ solution
12. Perform the isocyanide test, reduction test and Nessler reagent test for chloroform.
13. Perform the flashing test of ethyle alcohol.
14. Measure the meting point of hydrocarbon (Dalda) by capillary tube.
15. Measure the meting point of glucose, urea, oxalic acid by capillary tube.

REFERANCE 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

7142 ENGINEERING MECHANICS

T	P	C
3	3	4

AIMS

To provide the students with an opportunity to acquire knowledge, skill and attitude in the area of engineering mechanics with special emphasis on:

- force system, moment and couple
- center of gravity
- moment of inertia
- friction
- stress & strain
- Torsion
- shear force & bending moment
- work, power and energy
- simple lifting machines and gear train

SHORT DESCRIPTION

Force system, Moment and couple, Center of gravity & centroid, Moment of inertia, Friction, Stress & strain, Torsion, Shear force and bending moment, Work, power & energy, Simple lifting machines and Gear train.

DETAIL DESCRIPTION

Theory :

FORCE SYSTEM

1 Understand the composition and resolution of forces.

- 1.1 State the effect of forces.
- 1.2 Mention the characteristics of forces.
- 1.3 Learn the laws of forces.
- 1.4 Define resolution of forces.
- 1.5 Define resultant force and composition of forces.
- 1.6 Find the resultant force graphically and analytically.
- 1.7 Solve problems related to resultant forces.

MOMENT AND COUPLE

2 Understand the aspects of moment and couple of forces.

- 2.1 Define moment and couple of a force.
- 2.2 Represent the moment of a force geometrically.
- 2.3 State the laws of moments.
- 2.4 State the Varignon's principles of moments.
- 2.5 Proof the Varignon's principles of moments
- 2.6 Identify the clockwise and anticlockwise moment.
- 2.7 Distinguish between clockwise couple and anticlockwise couple.
- 2.8 Define leverage functions.
- 2.9 Solve problems related to moment and couple of forces.

3 Understand the aspects of equilibrium of forces.

- 3.1 Mention different system of forces.
- 3.2 Mention the various types of equilibrium of forces.

- 3.3 State the principles of equilibrium of forces.
- 3.4 State the Lami's theorem.
- 3.5 Express the derivation of Lami's theorem.
- 3.6 Describe different methods of the equilibrium of coplanar forces.
- 3.7 Explain the conditions of equilibrium.
- 3.8 Solve problems related to equilibrium of forces.

CENTER OF GRAVITY

4 Understand the concept of center of gravity.

- 4.1 Define center of gravity and centroid.
- 4.2 Distinguish between center of gravity and centroid.
- 4.3 Determine the center of gravity of simple geometrical figure geometrically and by integration.
- 4.4 Identify the axis of reference and axis of symmetry.
- 4.5 Determine the center of gravity of plain geometrical figure by first principle of moments.
- 4.6 Calculate the center of gravity of compound geometrical figure or areas by moments.
- 4.7 Calculate the center of gravity of solid bodies.

MOMENT OF INERTIA

5 Understand the application of moment of inertia.

- 5.1 Explain the term moment of inertia.
- 5.2 Mention the units of moment of inertia.
- 5.3 Express the derivation of the formulae for moment of inertia of an area.
- 5.4 Explain polar moment of inertia.
- 5.5 Describe the methods for finding out the moment of inertia.
- 5.6 Find the moment of inertia of a simple areas by integration.
- 5.7 State the theorem of perpendicular axis as applied to moment of inertia.
- 5.8 Prove the theorem of perpendicular as applied to moment of inertia.
- 5.9 State the parallel axis theorem.
- 5.10 Explain the radius of gyration and section modulus.
- 5.11 Calculate the moment of inertia and section modulus of simple solid bodies and composite sections.

FRICTION

6 Understand the principles and application of friction.

- 6.1 Define friction.
- 6.2 State the laws of static and dynamic friction.
- 6.3 Explain coefficient of friction.
- 6.4 Determine the frictional force of a body lying on horizontal and inclined plane.
- 6.5 Identify the ladder and wedge friction.
- 6.6 Describe the screw friction.
- 6.7 Solve problems on wedge and ladder friction.

STRESS AND STRAIN

7. Understand the aspect of stress and strain.

- 7.1 Define stress, strain, modulus of elasticity, modulus of rigidity, Bulk modulus, Poisson's ratio and principle of shear stress.
- 7.2 Establish the relation between stress and strain.
- 7.3 Explain the stress in composite bar, stress in nuts and bolts, and thermal stress.
- 7.4 Describe the linear and lateral strain.
- 7.5 Explain the stress-strain diagram.
- 7.6 Solve problems on stress and strain.

8. Understand the effects of torsion of solid and hollow shafts.

- 8.1 Explain torsion and torsion shear.
- 8.2 Deduce the equations used in case of designing solid and hollow shafts.
- 8.3 Deduce the equations of twist angle.
- 8.4 Solve problems using the equation of solid, hollow shafts and twist angle.

SHEAR FORCE AND BENDING MOMENT

9. Understand the fundamentals of shear force and bending moment.

- 9.1 Define beam.
- 9.2 Identify the types of beam.
- 9.3 Identify the types of loading on beam.
- 9.4 Determine the support reactions of different types of beam under different loading conditions.
- 9.5 Define shear force (SF) and bending moment (BM).
- 9.6 Differentiate shear force (SF) and bending moment (BM).
- 9.7 Explain the sign convention and characteristics of S.F and B.M diagram.
- 9.8 Draw S.F and B.M diagram of simple supported beams with point load and distributed load.
- 9.9 Draw S.F and B.M diagram of cantilever beams with point load and distributed load.

10. Understand the aspects of work, power and energy.

- 10.1 Define work, power and energy.
- 10.2 Explain the work done in rotation.
- 10.3 Mention the types of engine power.
- 10.4 State the meaning of the engine efficiency.
- 10.5 Mention the types of energy.
- 10.6 Express the derivation of the equation of kinetic energy.
- 10.7 Solve problems related to work, power and energy.

SIMPLE LIFTING MACHINES

11. Understand the principles of simple machines.

- 11.1 State the meaning of simple machine, compound machine and ideal machine.
- 11.2 Define the terms velocity ratio, mechanical advantage and efficiency of a machine.
- 11.3 Relate between efficiency, mechanical advantage and velocity ratio of lifting machine.
- 11.4 State the law of the machine.
- 11.5 Explain the reversibility of a machine and self locking machine.
- 11.6 Solve problems involving velocity ratio, mechanical advantage and efficiency of simple lifting machines.

12. Understand the various aspects of gear trains.

- 12.1 State what is meant by gear.
- 12.2 Identify the types of gears.
- 12.3 Identify the simple gear drive.
- 12.4 Express the derivation of the equation of velocity ratio of simple gear drive.
- 12.5 Identify the compound gear drive and gear train.
- 12.6 Identify the equation of power transmitted by simple and compound train.
- 12.7 Identify the epicyclic gear train.
- 12.8 Express the derivation of the velocity ratio of an epicyclic gear train.
- 12.9 Solve problems related to gear trains.

Practical :

- 1 Verify the triangle law of forces.
- 2 Verify the polygon law of forces.
- 3 Show the resultant of forces by using the force board.
- 4 Proof Lami's theorem by using the force board.
- 5 Determine the coefficient of friction of timber, concrete and mild steel.
- 6 Determine the tensile stress-strain by testing a mild steel specimen (also draw stress-strain diagram).
- 7 Determine the compressive stress of a timber specimen.
- 8 Determine the mechanical advantage of a screw jack.
- 9 Determine the center of gravity of a wooden block.
- 10 Determine the reaction of beam by using spring balance.

REFERENCE BOOKS

- 1 Structural Mechanics – W. Morgan and D.T Williams
- 2 Structure Mechanics – Singer/Popov
- 3 Applied Mechanics – R. S. Khurmi
- 4 Mechanics of Materials – Philip Guatave Laurson
Williams Junkin Cox.
- 5 Analytical Mechanics – Virgil Moring Faires
- 6 Vector mechanics for engineers - Beer and Johnston.
- 7 Engineering mechanics - P. L. Ballaney.

6355	REFRIGERATION AND COLD STORAGE	T	P	C
		2	3	3

AIMS

- To be able to understand the basic principles of refrigeration, cold storage and air-conditioning system.
- To be able to understand the refrigeration cycles of various methods.

- To be able to understand the operating principles of equipment used in vapor compression refrigeration system.
- To be able to understand the types and principles of refrigerants and their applications.
- To be able to understand the basic principles of cold storage.
- To be able to understand the air-conditioning mechanisms and their application.
- To be able to select the appropriate hand tools required for refrigeration work.

SHORT DESCRIPTION

Common terms used in refrigeration; Methods of heat transfer; Pressure temperature (BP) relationship; Pressure gauges; Introduction to refrigeration; Refrigerants; Vapor compression cycle; Components of vapor compression system; Evacuation process of a refrigeration unit; Charging system of a refrigeration unit; Absorption refrigeration system; Accessories used in refrigeration system; Different types of cold storage; Determination of U-factor; Cooling load; Air-conditioning fundamentals; Air-Conditioning system used in both summer & winter; multi zone air-conditioning system.;

DETAILED DESCRIPTION

Theory:

1 Understand the common terms used in refrigeration.

- 1.1 Explain the terms: temperature, pressure, absolute temperature, absolute pressure, heat, specific heat, sensible heat, latent heat, thermal capacity, mechanical equivalent of heat, power, evaporation, condensation, saturated temperature, sub-cooled liquid, dry saturated vapor, wet saturated vapor, super heated vapor, density, specific volume, dry-bulb temperature, wet bulb temperature, psychometric chart, humidification and dehumidification.
- 1.2 Explain the conversion of temperature from one scale to another.
- 1.3 Solve problems related to temperature and heat.

2 Understand the method of heat transfer.

- 2.1 Explain conduction, convection and radiation.
- 2.2 Explain the application of heat transfer in the field of refrigeration.
- 2.3 Describe the working principle of heat exchanger.
- 2.4 Solve problems on heat transfer.

3 Understand pressure gauges.

- 3.1 Explain pressure gauges.
- 3.2 Explain compound gauges.
- 3.3 Distinguish between pressure gauges, compound gauges and vacuum gauges.

4 Understand the introduction of refrigeration.

- 4.1 Define refrigeration.
- 4.2 Explain the importance of refrigeration.
- 4.3 List the different types of refrigeration.
- 4.4 Mention the industrial application of the refrigeration system.

5 Understand the vapour compression refrigeration system.

- 5.1 Explain vapour compression refrigeration system.
- 5.2 Describe the development of vapour compression system from ice refrigeration.
- 5.3 List the components of vapour compression system.
- 5.4 Explain the working principle of a V-C refrigeration system.
- 5.5 Mention the high side and low side components.
- 5.6 State what is meant by p-h diagram.
- 5.7 Draw a typical p-h diagram.
- 5.8 Represent vapour compression refrigeration cycle on p-h diagram at different condition.

6 Understand the compressors and condensers of vapor compression system.

- 6.1 Define the compressor's function in refrigeration system.
- 6.2 Describe different types of compressor.
- 6.3 Distinguish between open and sealed type (hermetic) compressor.
- 6.4 Explain the function and properties of oil in compressors.
- 6.5 Describe the construction & working principle of rotary vane type compressor.
- 6.6 Describe construction & working principle of reciprocating compressor.
- 6.7 Define condenser's function in refrigeration system.
- 6.8 List the different types of condensers in refrigeration system.
- 6.9 Explain the application of the air cooled and water cooled condensers.

7 Understand the expansion devices and evaporators of vapor compression system.

- 7.1 List the different types of refrigerant control device (expansion device).
- 7.2 Explain the high side and low side float control.
- 7.3 Explain the capillary control device.

- 7.4 Draw & explain the automatic expansion valve.
- 7.5 Explain thermostatic expansion valve with neat sketch.
- 7.6 Classify evaporators on the basis of surface, operating condition, refrigerant control and circulation.
- 7.7 Define the evaporator's function in refrigeration system.

8 Understand the accessories used in refrigeration system.

- 8.1 List the accessories used in refrigeration system.
- 8.2 Describe the construction and function of refrigeration system accessories (sight glass, drier or dehydrator, strainer, oil separator, heat exchanger, accumulator, flush chamber, pressure relief valve etc.).

9 Understand the different types of refrigerants, their properties & uses.

- 9.1 Make a list of important refrigerants.
- 9.2 Classify the refrigerants.
- 9.3 State the important properties of an ideal refrigerant.
- 9.4 Describe properties and uses of the following refrigerants:
R-11(Freon-11), R-12, R-22, R-23, R-134-A, R-404, R-407, R-500, R-502, R-600, ammonia, carbon dioxide.
- 9.5 Define halocarbon refrigerant, hydro carbon refrigerant, inorganic refrigerant and azeotropic refrigerant.
- 9.6 Describe the designation system of refrigerants.
- 9.7 Mention the color code of refrigerant cylinder.
- 9.8 Define the meaning of CFC and environmental friendly refrigerants.

10 Understand the evacuation and charging system of a refrigeration unit.

- 10.1 State evacuation of a refrigeration system.
- 10.2 Explain the purpose of evacuation.
- 10.3 Explain gage manifold and its operation.
- 10.4 Explain evacuation with the help of a compressor.
- 10.5 Explain evacuation with the help of a vacuum pump.
- 10.6 Explain the steps of charging system of an unit with the help of suction valve.
- 10.7 Explain the procedures of charging an unit with the help of charging valve.

11 Understand the absorption refrigeration system.

- 11.1 Describe the absorption cycle used in refrigeration.
- 11.2 Explain the two types of absorption system (NH₃-water & LiBr-water system).

- 11.3 Name the components of a simple absorption refrigeration system.
- 11.4 Draw a neat sketch of absorption refrigeration system.
- 11.5 Distinguish between V-C and V-A refrigeration system.

12 Understand the cold storage.

- 12.1 Explain cold storage and its classification.
- 12.2 Explain short term and long term cold storage and frozen storage.
- 12.3 Explain the factors effect the site selection for a cold storage.
- 12.4 Explain storage temperature and humidity of different products.
- 12.5 Explain the chilling method.
- 12.6 Explain the freezing methods.
- 12.7 Explain the system of food (potato, seeds etc) storage.

13 Understand U-factor and the fundamentals of cooling load.

- 13.1 Define U-factor.
- 13.2 Explain the calculation of U-factor.
- 13.3 Define cooling load.
- 13.4 List the different types of cooling load.
- 13.5 Explain wall gain load.
- 13.6 Explain air change load.
- 13.7 Explain product load.
- 13.8 Explain supplementary load.
- 13.9 Explain the different factors which influence the cooling load and capacity of a cold storage.
- 13.10 Explain the causes of hazards.
- 13.11 Solve problems on cooling load.

14 Understand the aspect of ice and ice cream making.

- 14.1 State the necessity of ice making.
- 14.2 List the raw materials required to make ice cream.
- 14.3 Explain the preparation of ice cream.
- 14.4 Describe the storing of ice cream.
- 14.5 Outline the marketing of ice cream.
- 14.6 Describe the process of making ice cubes.

15 Understand the air-conditioning fundamentals.

- 15.1 Define air-conditioning.
- 15.2 Describe the scope of air-conditioning.
- 15.3 Describe factors to be considered for air-conditioning a space or a building.

- 15.4 Describe the components of an air-conditioning system.
- 15.5 Name the different types of air-conditioning system.
- 15.6 Name the components of a conventional air-conditioning system.
- 15.7 Describe the operation of a conventional air-conditioning system which used in summer, winter or all year.

Practical :

1. Identify the basic hand tools used in refrigeration, cold storage and air-conditioning workshop physically.
2. Practice the cutting, bending, swaging, flaring, soldering and brazing of tubes used in refrigeration system.
3. Dismantle and identify the different parts of a reciprocating compressor, (open, semi open and hermetic types) centrifugal and rotary compressor and reassembling the different parts.
4. Identify different parts of vapor compression refrigeration system of a refrigeration unit/model.
5. Observe the operation of vapour absorption refrigeration and identify the major parts.
6. Identify a capillary tube, an automatic expansion valve, a thermostatic expansion valve.
7. Study the operation of gage manifold.
8. Measure the equilibrium pressure at high side & low side of V-C cycle by compound gauge.
9. Evacuate a domestic refrigerator by a compressor or vacuum pump and charge it properly.
10. Determine the cooling load of a room and mention the type of air conditioner required.
11. Visit a modern cold storage (MSPC).
12. Analyse the insulation of the wall and roof of cold storage.

REFERENCE BOOKS

1. Introduction to Refrigeration and Air-conditioning – Bishnu pada paul.
2. “Basic Refrigeration and Air-conditioning” Expert committee Technical Teachers Training college ;Tejgaon, Dhaka-1208.
3. Refrigeration and Air-conditioning – M. M. Rahman
4. Operation of Refrigeration and Air-conditioning – M. A. S Khan, M. Solaiman and M. A. Basher; Technical Teachers Training College, Dhaka.
5. Basic Refrigeration and Air-conditioning – P. N. Ananthanarayanan; Tata Mcgraw-Hill publishing company Ltd. New Delhi.
6. Refrigeration and Air-conditioning – P. L. Ballaney; Khanna Publishers; Delhi-110006.
7. A text Book of Refrigeration and Air-conditioning – R. S. khurmi; K. J. K. Gupta; Eurasia Publishing House (p) Ltd; New Delhi-110055.

8. Air-conditioning and Refrigeration – William H. Severns & Julian R Fellows John wiley and sons Inc; London; Tpppan Company Ltd. Tokyo Japan.
9. Refrigeration and air-conditioning – V. K. Jain; S Chand and Company Ltd. (Latest edition-S. I unit); New Delhi-110055.
10. Principle of Refrigeration – Roy J. Dossat; Wiley Eastern Limited, New Delhi.

5851	BOOK KEEPING & ACCOUNTING	T	P	C	
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AIMS

- To be able to understand the principles and practices of book keeping and accounting.
- To be able to understand the procedures of general accounting, financial accounting and their applications.

SHORT DESCRIPTION

Concept of book keeping and accounting; Transactions; Entry systems; Accounts; Journal; Ledger; Cash book; Trial balance; Final accounts; Cost account & financial accounting; Depreciation; Public works accounts.

DETAIL DESCRIPTION

1 Understand the concept of book keeping and accounting.

- 1.1 Define book keeping and accountancy.
- 1.2 State the objectives of book keeping.
- 1.3 State the advantages of book keeping.
- 1.4 Differentiate between book keeping and accounting.
- 1.5 State the necessity and scope of book keeping and accounting.

2 Understand the transactions.

- 2.1 Define transactions and business transaction.
- 2.2 Explain the importance of transactions.
- 2.3 Describe the characteristic features of transactions.
- 2.4 Discuss the classification of transaction.
- 2.5 Identify the transaction from given statements stating reasons.

3 Understand the entry system.

- 3.1 State the aspects of transactions.
- 3.2 Define single entry system.
- 3.3 State the objectives of single entry system.
- 3.4 Discuss the disadvantages of single entry system.
- 3.5 Define double entry system.
- 3.6 Discuss the principles of double entry system.
- 3.7 Justify whether double entry system is an improvement over the single entry system.
- 3.8 Distinguish between single entry and double entry system of book keeping.

4 Understand the classification of accounts.

- 4.1 Define accounts.
- 4.2 State the objectives of accounts.
- 4.3 Illustrate different type of accounts with example.
- 4.4 Define "Golden rules of Book keeping".
- 4.5 State the rules for "Debit" and "Credit" in each class of accounts.
- 4.6 Determine Debtor (Dr) and Creditor (Cr.) from given transactions applying golden rules.
- 4.7 Define accounting cycle.
- 4.8 State the different steps of accounting cycle.

5 Understand the Journal.

- 5.1 Define Journal.
- 5.2 State the object of Journal.

- 5.3 State the functions of Journal.
- 5.4 Mention the various names of Journal.
- 5.5 Interpret the form of Journal.
- 5.6 Journalize from given transactions.

6 Understand the ledger.

- 6.1 Define ledger.
- 6.2 Interpret the form of ledger.
- 6.3 State the functions of ledger.
- 6.4 Distinguish between Journal and Ledger.
- 6.5 Prepare ledger from given transactions.
- 6.6 Explain why ledger is called the king of all books of accounts.

7 Understand the cash book.

- 7.1 Define cash book (single, double and triple column).
- 7.2 Explain cash book as both Journal and Ledger.
- 7.3 Prepare double column cash book from given transactions showing balances.
- 7.4 Prepare triple column cash book from given transaction and find out the balances.
- 7.5 Define petty cash book.
- 7.6 Prepare analytical and imprest system of cash book.
- 7.7 Define discount.
- 7.8 Explain the different types of discount.

8 Understand the trial balance.

- 8.1 Define trial balance.
- 8.2 State the object of a trial balance.
- 8.3 Discuss the methods of preparation of a trial balance.
- 8.4 Explain the limitations of a trial balance.
- 8.5 Prepare trial balance from given balance.

9 Understand the final accounts.

- 9.1 State the components of final account.
- 9.2 Distinguish between trial balance and balance sheet.
- 9.3 Identify the revenue expenditure and capital expenditure.
- 9.4 Select the items to be posted in the trading account, profit & loss account and the balance sheet.
- 9.5 State the adjustment to be made from the given information below or above the trial balance.
- 9.6 Prepare trading account, profit & loss account and balance sheet from the given trial balance & other information.

10 Understand the cost and financial accounting.

- 10.1 Define financial accounting.
- 10.2 State the objectives of financial accounting.
- 10.3 Define cost accounting.
- 10.4 Discuss the relationship between financial Accounting and cost accounting.
- 10.5 State the elements of direct cost and indirect cost.
- 10.6 Prepare cost sheet showing prime cost, factory cost, cost of production, total cost and selling price.
- 10.7 Discuss the capital budgeting
- 10.8 Discuss the discounted cash flow method
- 10.9 Explain the following terms:
 - a. Fixed cost b. Variable cost c. Factory cost d. Overhead cost e. Process cost
 - f. Direct cost g. Operating cost h. Standard cost

11 Understand the depreciation

11.1 Define depreciation.

11.2 State the objects of depreciation.

11.3 Discuss the necessity for charging depreciation.

11.4 Describe the different methods of determining depreciation.

11.5 Explain the relative merits and demerits of different method of depreciation.

12 Understand the public works accounts.

12.1 State the important aspects of public works accounts.

12.2 Describe the main features of public works accounts.

12.3 Explain "Revenue and Grant".

12.4 Define Value Added Tax (VAT)

12.5 State the merits and demerits of VAT.

12.6 Define Bill and Voucher.

4-YEAR DIPLOMA-IN-ENGINEERING PROGRAM

FOOD TECHNOLOGY(69)

SYLLABUS
(COURSE STRUCTURE-2010)

SIXTH SEMESTER

AIMS:

- To be able to understand the food engineering, unit operation & unit process.
- To be able to understand the flow of fluids.
- To be able to find out the fluid pressure and flow rate of fluid.
- To be able to understand the different types of pumps and compressors.
- To be able to understand the mixing.
- To be able to perform experiment of food engineering operation.

SHORT DESCRIPTION

Basic concept of food engineering; flow of fluids; Energy and momentum relationship in fluid; Bernoulli's equation; types of flow, flow of compressible fluids and two phase flow; measurement of flow and pressure of fluid; Centrifugal pumps; Positive displacement pumps; Rotary pumps; Pumping equipment for gases; Transportation of solids; Mixing and agitation; crystallization; emulsification; irradiation.

DETAIL DESCRIPTION**Theory:****16. Understand the basic concept of food engineering.**

- 16.1 Define food engineering.
- 16.2 Explain unit operations and unit process.
- 16.3 Make a list of important unit operations of food engineering.
- 16.4 Explain the importance of unit operations in food process industries.

17. Understand the flow of fluids.

- 17.1 Define fluid.
- 17.2 Mention the classification of fluid.
- 17.3 Explain the properties of fluid.
- 17.4 Explain pressure of fluid.
- 17.5 Describe barometric pressure, gage pressure and absolute pressure.
- 17.6 Explain the pressure of liquid column.
- 17.7 Mention the fundamental equations of hydrostatics.

18. Understand the continuity equation and Bernoulli's equation.

- 18.1 Define internal energy of the fluid.
- 18.2 Describe the incompressible fluids.
- 18.3 Mention the equation of continuity.
- 18.4 Express the Bernoulli's equation.
- 18.5 Explain the total energy of a fluid in motion.
- 18.6 Describe the pressure and fluid head.
- 18.7 Describe the constant flow of fluid per unit area.
- 18.8 Solve problems on Bernoulli's equation.

19. Understand the friction in pipes and channels.

- 19.1 Describe the friction in pipes and channels.

- 19.2 Explain nature of fluid flow.
- 19.3 Describe shearing characteristics of a fluid.
- 19.4 Explain drop in pressure for flow of fluid through a tube.
- 19.5 Describe pressure drop along a pipe through which fluid is flowing.

20. Understand the types of flow.

- 20.1 Define laminar, transition and turbulent flow.
- 20.2 Describe “Reynolds number (Re)”.
- 20.3 Define viscosity of a fluid.
- 20.4 Describe velocity distribution in streamline flow.
- 20.5 Describe velocity distribution in turbulent flow.
- 20.6 Explain friction losses for incompressible fluids for sudden enlargement and sudden contraction of pipe diameter.
- 20.7 Explain friction losses due to pipe fittings for incompressible fluids.

21. Understand the measurement of flow and pressure of fluids.

- 21.1 Explain the term “fluid pressure”.
- 21.2 Make a list of pressure measuring devices.
- 21.3 Make a list of flow measuring devices.
- 21.4 Describe the measurement of pressure difference by simple manometer.
- 21.5 Describe the measurement of pressure difference by U-tube manometer and inverted manometer.
- 21.6 Describe the methods of measurement of flow by the pitot tube.
- 21.7 Describe the methods of measurement of flow of fluid by the orificemeter, venturimeter and rotameter.

22. Understand the pumping of fluids.

- 22.1 Mention the pumping of fluids.
- 22.2 Make a list of different types of pumps.
- 22.3 Make a list of factors which influence the choice of pump for a particular operation.
- 22.4 Explain the term pump heads.
- 22.5 Describe the classification of pumps.
- 22.6 Mention the function of a gate valve and globe valve.

23. Understand the centrifugal pumps.

- 23.1 Define centrifugal pump.
- 23.2 Explain virtual head of centrifugal pumps.
- 23.3 Describe the operating characteristics of centrifugal pump.
- 23.4 Describe net positive suction head (NPSH) of centrifugal pumps.
- 23.5 Mention the classification of centrifugal pumps.
- 23.6 Explain the efficiency of centrifugal pumps.
- 23.7 Mention the advantages and disadvantage of centrifugal pumps.

24. Understand the positive displacement pumps.

- 24.1 Describe positive displacement pumps.
- 24.2 Describe the construction of a reciprocating piston pump.
- 24.3 Describe the operation of a reciprocating piston pumps.
- 24.4 Draw a sketch of a diaphragm pump.
- 24.5 Describe the principle of operation of diaphragm pump.
- 24.6 Mention the uses of diaphragm pump.
- 24.7 Make a list of all parts of a single acting reciprocating pump.

- 24.8 Describe the construction of rotary pumps.
- 24.9 Describe the operation of rotary pumps.
- 24.10 Describe the construction of the flow inducer or peristaltic pump.

25. Understand the transportation of solids.

- 25.1 Define conveyors.
- 25.2 Describe gravity conveyors.
- 25.3 Make a list of devices for the transportation of solids.
- 25.4 Describe the followings: (i) Roller conveyors, (ii) Belt conveyors, (iii) Chain conveyors, (iv) Slat conveyors, (v) Vibratory conveyors, (vi) Magnetic conveyors, (vii) Screw conveyors, (viii) Flight conveyors.
- 25.5 Mention elevators.
- 25.6 Describe flight elevators and bucket elevators.
- 25.7 Describe pneumatic conveying systems.

26. Understand the mixing and agitation.

- 26.1 Define mixing.
- 26.2 Mention the reasons for mixing of materials in industries.
- 26.3 Mention the classification of mixing equipment.
- 26.4 Describe the mixing of liquids with propeller/turbines.
- 26.5 Describe the mixing of solid particles.
- 26.6 Describe the following equipment: (i) Anchor paddle mixer, (ii) Kneaders, (iii) Pug mill, (iv) Double cone mixer, (v) Propeller agitators, (vi) Turbine agitators.

27. Understand the emulsification.

- 27.1 Define emulsification.
- 27.2 Describe emulsification agents.
- 27.3 Describe the methods of emulsification.
- 27.4 Describe pressure homogenizer.
- 27.5 Describe the colloid mills.
- 27.6 Describe using of emulsification of food industry.

28. Understand the basic concept of crystallization.

- 28.1 Define crystallization.
- 28.2 Mention the classification of crystals.
- 28.3 Explain the terms: crystallization rate (nucleation and crystal growth), crystal habit, caking of crystal.
- 28.4 Mention the control of caking crystal.
- 28.5 Mention the factors for controlling crystal growth.
- 28.6 Explain the effect of impurities on crystal formation.
- 28.7 Describe the effect of temperature on solubility.

29. Understand the crystallization equipment.

- 29.1 Mention the classification of crystallizer.
- 29.2 Explain batch crystallizers and continuous crystallizers.
- 29.3 Describe the construction of batch crystallizers (tank crystallizer, evaporator).
- 29.4 Describe growth type crystallizer and its operation.
- 29.5 Describe the vacuum crystallizer and its operation.
- 29.6 Describe the crystal crystallizer (i.e oslo crystallizer) and its operation.

30. Understand the Irradiation.

- 30.1 Define irradiation.
- 30.2 Describe radiation pasteurization and radiation sterilization.
- 30.3 Describe the apply radiation ray using in food preservation.
- 30.4 Describe effect of irradiation of food.
- 30.5 Describe food processing by irradiation methods.
- 30.6 Describe radiation resistance of microorganisms.

PRACTICAL:

- 13. Determine the specific gravity of various types of incompressible fluids.
- 14. Determine the surface tension of different types of liquids.
- 15. Determine the viscosity of different liquids.
- 16. Measure the pressure of an incompressible fluid flowing in a pipe with the help of U-tube manometer.
- 17. Measure the pressure of an incompressible fluid flowing in a pipe with the help of inclined manometer.
- 18. Measure the flow rate of a pipe with the help of venture meter.
- 19. Measure the flow rate of a pipe with the help of orifice meter.
- 20. Measure the flow rate of a pipe with the help of rota meter.
- 21. Verify the Bernoulli`s equation.
- 22. Disassemble, clean all parts and then reassemble a volute type centrifugal pump.
- 23. Disassemble, clean all parts and then reassemble a diffuser type centrifugal pump.
- 24. Prime manually a centrifugal pump and then operate the centrifugal pump.
- 25. Disassemble, clean all parts and reassemble a four stage centrifugal pump.
- 26. Operate a pan mixer.
- 27. Operate a vacuum pump.
- 28. Clean and maintain the vacuum pump.
- 29. Operate a propeller agitator.
- 30. Operate a pressure homogenizer for milk homogenization.

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AIMS

- To be able to understand the food processing technology.
- To be able to prepare different food products hygienically and economically.
- To be able to know-how to exploit and explore the natural resources of Bangladesh to develop food process industries.

SHORT DESCRIPTION

Water, Fruits and vegetables; Preprocessing operations of fruit and vegetables; Processing of fruits and vegetable; Products and by products of fruits and vegetables; Cereal and cereal products; Cereal Processing & milling; Fat; Oils; Spices; Legumes and pulses; Sugar and Salt.

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

- 1.1 Define water treatment.
- 1.2 List the impurities in water
- 1.3 Explain the treatment of water for municipal purpose.
- 1.4 Explain the softening of water by lime soda process
- 1.5 Explain the softening of water by organic ion exchanger

2 Understand the basic concept of fruits and vegetables.

- 2.1 Describe fruits and vegetables with chemical compositions.
- 2.2 Describe classification of fruits and vegetables with example.
- 2.3 Describe the principles of fruits and vegetables processing.
- 2.4 Describe the processing methods of fruits and vegetables.

3 Understand the pre-processing operations of fruits and vegetables.

- 3.1 Explain pre-processing operation of fruits and vegetables.
- 3.2 Importance of pre-processing operation of fruits and vegetables.
- 3.3 Stapes of pre-processing operation of fruits and vegetables.
- 3.4 Briefly describe the blanching of vegetables.
- 3.5 Describe the objective of adding syrup and brine solution to fruits and vegetables.
- 3.6 Mention the strength of syrup and brine solution for fruits and vegetables.
- 3.7 Explain the procedure of preservation of fruits and vegetables
- 3.8 Describe the methods of canning of fruits and vegetables.

4 Understand the manufacture of products and by products from fruits.

- 4.1 List different types of products of fruits.
- 4.2 Describe the important steps involved in processing of fruit juice.
- 4.3 Describe the procedure of making fruits juice concentrate.
- 4.4 Describe the procedure of making pickle from mango.
- 4.5 List different type of by- product of fruits.
- 4.6 Explain the uses of waste-materials of fruits.
- 4.7 Describe the by-products obtained from citrus fruits.

5 Understand the manufacture of products and by products from vegetables.

- 5.1 List different types of products of vegetables.
- 5.2 Describe the procedure of potato starch manufacturing.
- 5.3 List different type of by- product of vegetables.
- 5.4 Describe the method of disposal of food plant wastes.
- 5.5 Describe the manufacturing procedure of alchole from molasses/starch
- 5.6 Describe Tea processing procedure from leaf.
- 5.7 Describe coffee processing procedure from seed.

6 Understand the concept of Fats and oils.

- 6.1 Define fats and oils.
- 6.2 Classification of fats and oils.
- 6.3 Describe nutritive value of fats and oils.
- 6.4 Explain the physical and chemical properties of fats and oils.
- 6.5 Mention the uses of fats and oils in food processing.
- 6.6 Describe the process of hydrogenation of fats and oils.
- 6.7 Describe the methods of refining vegetables oils/ Crude Degumming Soya been Oil (CDSO).
- 6.8 Explain the extraction & filtration process of mustered oil from seed.

7 Understand the concept of cereal & cereal products.

- 7.1 Define cereals.
- 7.2 Mention the different names of cereal crops.
- 7.3 Describe the milling process of rice (Full boiled/ half boiled/ without boiled)
- 7.4 Describe boiling of effect of rice.
- 7.5 Mention three types of wheat.
- 7.6 Describe milling process of wheat (Atta/ Flour/ Semolina)
- 7.7 Describe the milling procedure of Maize.

8 Understand the concept of spices.

- 8.1 Define spices.
- 8.2 Describe classification of spice.
- 8.3 Make a list of spice.
- 8.4 Describe the function of spices.
- 8.5 Describe the processing of red pepper.
- 8.6 Describe the processing of turmeric.
- 8.7 Describe the processing of ginger, onion, garlic, coriander and cinnamon.
- 8.8 Describe the uses of spice.

9 Understand the concept of legumes and pulses.

- 9.1 Define legumes and pulses.
- 9.2 Describe the nutritive value of legumes.
- 9.3 Describe the post harvest technology of legumes and pulses.
- 9.4 Describe the milling of legumes.
- 9.5 Describe different products obtained from legumes.
- 9.6 Describe the nutritive value of soya bean.
- 9.7 Describe the processing of soya milk.

10. Understand the concept of Salt

- 10.1 Define salt.
- 10.2 Types of salt and salt processing.
- 10.3 Fortification of salt.
- 10.4 Describe refining process of evaporated salt.
- 10.5 Refining process of iodized salt.(Mechanical/Vacuum refinery)
- 10.6 Describe refining process of rock salt.
- 10.7 Mention the composition if different process salt composition.

11 . Understand the concept of Sugar

- 11.1 Define sugar.
- 11.2 Describe sugar chemistry and nutrition value.
- 11.3 Classification of sugar according source.
- 11.4 Describe beet sugar processing and refining.
- 11.5 Describe cane sugar processing and refining.
- 11.6 Mention different forms and use of sugar.(Icing sugar, granulated sugar, inverted sugar, brown sugar, liquid sugar)

PRACTICAL :

1. Field visit to identify the types of fruits and vegetables.
2. Determine the temporary/ permanent hardness of water.
3. Prepare plain vinegar/ spices vinegar.
4. Post harvest of fruits and vegetables. (Brine solution, sugar syrup, sulphar-dioxiede, sodium benzoate, fermentation /vinegar).
5. Tomato pulp/ mango pulp / papaya pulp processing.
6. Juice making by pre-processing pulp / Raw fruits.
7. Pickle processing by (Green mango/ Olive/ Garlic/ Cucumber/ Onion/ Chili)
8. Chutney processing (Tamarind/ Berry/ Olive/ Mango/ Mixed fruits)
9. Sugar concentrate products processing (Jam/ Jelly/ Squash/ Candy/ Murubba)
10. Pulp concentrate products processing (Mango bar)
11. Deep fry potato products (Chips/ Crackers/ France fry)
12. Margarine processing.
13. Manufacture processing of cereals pre-mix.
14. Soya milk processing.
15. Processing of spicy seasoning for snacks.
16. Processing of curry powder (Meat/ Fish/ Chicken)

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3. Food Processing Plants (Vol I & II)
-by Slade
4. A Hand Book of Edible Oils and Fats
-by Golam Mowla, N M Sheikh, and A. S. M Sarwar Kamal.
5. Modern Cereal Chemistry
-by Kent Jones and Amos.
6. Principles of Dairy Processing
-by Wanner J. N.
7. Industrial Fishery Technology
-by Manrice E. Staus by.

8. Encyclopedias of Food Technology

-by Johnson and Peterson.

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-by S. M Arora and Sisir Kumar Nath.

১০. দুগ্ধ বিজ্ঞান

- ডঃ মোঃ আবদুল হামিদ মিয়া

11. Food Science

By N. H. Potter

12. Food Processing and Preservation

By Siva Sanker

6363

INDUSTRIAL INSTRUMENTATION AND PROCESS CONTROL

T P C
2 3 3

AIMS:

- To be able to understand the modern concepts of industrial instrumentation.
- To be able to understand the concepts of temperature measurement and temperature measuring devices.
- To be able to understand the concepts of pressure measurement and pressure measuring devices.
- To be able to understand the concepts of level measurement and level measuring devices.
- To be able to understand the concepts of flow measurement and flow measuring devices.
- To be able to understand the concepts of humidity measurement and humidity measuring devices.
- To be able to understand the concepts of data transmission and control.
- To be able to understand the concepts of controller principle.
- To be able to calibrate, operate and maintain the different instruments and transducers.

SHORT DESCRIPTION

Measurement system; Transducers; Measuring terms; Temperature measurement and temperature measuring devices; Pressure measurement and pressure measuring devices; Level measurement and level measuring devices; Flow measurement and flow measuring devices; Humidity measurement and Humidity measuring devices; Transmission; Control and controller; Display devices and Recorders:

DETAILED DESCRIPTION:

Theory:

1. Understand the concepts of measurement systems.

- 1.1 Define meaning of measurement and measurement system.
- 1.2 Define instrument.
- 1.3 Explain the functions of instruments.
- 1.4 Explain the characteristics of instruments.
- 1.5 Draw the block diagram of a generalized measurement system.
- 1.6 Define calibration.
- 1.7 Describe the calibration method of measuring instrument scale by Dead Weight Tester.

2. Understand the Transducers.

- 2.1 Explain the following terms with examples.
 - (i) Transducer.
 - (ii) Signal conditioning.
 - (iii) Display.
- 2.2 Make a list of transducers with their uses.
- 2.3 Describe the classification of transducers with examples.
- 2.4 Differentiate between the following terms.

- (i) Transducers and inverse transducers.
- (ii) Active and passive transducers.
- (iii) Primary and secondary transducers.
- (iv) Analog and digital transducers.
- (v) Output and input transducers.

2.5 Describe the different criteria for selection of transducers for particular applications.

3. Understand the following measuring terms.

Accuracy, Sensitivity, Reproducibility or Repeatability, Drift, Error, Dead zone, Resolution, Percentage error, Zero error, Tolerance, Stability, Constancy, full scale deflection, Secular changer, Hysteresis, Step input, Range and span, Response time, Capacity, Precision, Linearity, Primary and secondary standard.

4. Understand the temperature measurement and temperature measuring devices.

4.1 Make a list of temperature measuring instruments.

4.2 Explain the relation between temperature and metal resistance.

4.3 Explain the construction and working principle of Resistance Temperature Detectors (RTD).

4.4 Explain the principle, constructional detail and operation of Thermistor.

4.5 Explain the construction and working principle of a Bimetallic Thermometer.

4.6 Make a list of six couple of materials of wire used in making of Thermo-couples with range of temperature in each case.

4.7 Explain the construction and working principle of a Thermo-couple.

4.8 Discuss the advantages and disadvantages of a thermo-couple.

5. Understand the Pressure spring thermometer and Optical devices.

5.1 Explain the working principle of gas thermometer.

5.2 Explain the working principle of vapor pressure thermometer.

5.3 Explain the working principle of liquid expansion thermometer.

5.4 Define pyrometer.

5.5 Describe the principle, construction and operation of optical pyrometer.

5.6 Describe the principle, construction and operation of total radiation pyrometer.

6. Understand the Pressure measurement and pressure measuring devices.

6.1 Make a list of pressure measuring instruments.

6.2 Explain the principle of U-tube, Inclined tube and well-type manometer in measuring differential pressure.

6.3 Mention six commonly used manometric liquid and write its important characteristics.

6.4 Make a list of six elastic deformation pressure elements.

6.5 Describe the function of pressure capsules in measuring pressure.

6.6 Describe the function of pressure bellows in measuring pressure.

6.7 Describe the constructional detail of C-type bourdon tube pressure gauge and its operation.

6.8 Explain the working principle of following electronic devices for the measurement of pressure.

- (i) Potentiometric device.
- (ii) Linear variable differential transformer(LVDT).
- (iii) Pirani gauge.

7. Understand the Level measurement and Level measuring devices.

7.1 Define level.

7.2 Classification of level measuring instruments.

7.3 Describe the measurement of level by bob and tape.

- 7.4 Describe the measurement of level by sight glass.
- 7.5 Describe the measurement of level by floats with pulley, floats with shaft and the doughnut shaped float with magnets.
- 7.6 Explain the measurement of level by pressure gauge, air trap and diaphragm box
- 7.7 Describe the measurement of level by manometer.
- 7.8 Explain the measurement of level by Ultrasonic method.
- 8. Understand the flow measurement and flow measuring devices.**
 - 8.1 Define flow rate and total flow.
 - 8.2 Make a list of flow measuring devices.
 - 8.3 Describe the measurement of flow by using venturimeter.
 - 8.4 Describe the measurement of flow by using orificemeter.
 - 8.5 Define variable area meter.
 - 8.6 Describe the measurement of flow by using rota meter.
 - 8.7 Describe the measurement of flow by using electro-magnetic meter.
 - 8.8 Describe the method of measurement of flow rate of a fluid by using turbine meter.
- 9. Understand the humidity measurement and humidity measuring devices.**
 - 9.1 Define the terms of absolute humidity, relative humidity, moisture and dew point.
 - 9.2 Explain dry and wet bulb temperature.
 - 9.3 Explain humidity chart.
 - 9.4 Describe the working principle of hygrometer.
 - 9.5 Describe the working principle of a sling psychrometer in measuring humidity.
 - 9.6 Discuss the method of measurement of dew point by a continuous dew point recorder.
 - 9.7 Describe the measurement of moisture by using moisture balance.
- 10. Understand Transmission.**
 - 10.1 Describe importance of transmission.
 - 10.2 Describe transmission with block diagram.
 - 10.3 Explain flapper-nozzle mechanism system uses flapper-nozzle mechanism.
 - 10.4 Describe pneumatic transmission.
 - 10.5 Explain electrical transmission, inductance transmission and impulse transmission
- 11. Understand control.**
 - 11.1 Define automatic control.
 - 11.2 Elements of process control system.
 - 11.3 Describe automatic control system with block diagram.
 - 11.4 Discuss ON-OFF control system(two step and three step).
 - 11.5 Describe the automatic temperature control of a reservoir.
- 12. Understand controller principles.**
 - 12.1 Define the terms: Process load, Process lag, Controller modes.
 - 12.2 Describe the essential elements of analog controller.
 - 12.3 Describe the working principle of pneumatic controller.
 - 12.4 Describe direct digital control system.
 - 12.5 Describe the cascade control.
- 13. Understand Display devices and Recorder.**
 - 13.1 Define display and recorder.
 - 13.2 Explain the light emitting diodes (LED) and light crystal diodes(LCD).
 - 13.3 Discuss the uses of LED.
 - 13.4 Discuss the digital volt meter(DVM).
 - 13.5 Describe the digital recorder (magnetic tape recorder).
 - 13.6 Describe the pneumatic type recorder.
 - 13.7 Describe the X-Y recorder.

PRACTICAL

- 01.** Measure the temperature of a fluid by using a mercury glass thermometer.
- 02.** Measure the temperature of steam/hot water by using a bimetallic thermometer.
- 03.** Measure the temperature of a furnace/oven by using a thermo-couple.
- 04.** Measure the temperature of a furnace/oven by using a platinum resistance thermometer.
- 05.** Measure the temperature of a furnace/oven by using an optical pyrometer.
- 06.** Measure the pressure of fluid by using a U-Tube manometer.
- 07.** Measure the pressure of fluid by using a C-Type Bourdon tube pressure gauge.
- 08.** Measure level of a vessel/container by using a sight glass.
- 09.** Measure the flow rate of fluid by using an orifice meter.
- 10.** Measure the flow rate of fluid by using a Venturi meter.
- 11.** Determine absolute and relative humidity by using a sling psychrometer.
- 12.** Determine moisture in milk powder by using a moisture balance.
- 13.** Record the temperature of an oven by a circular recorder.
- 14.** Measurement of dew point by a continuous dew point recorder.

REFERENCE BOOKS

- 1.** Electrical and electronics measurement and instruments – A K Sawhney.
- 2.** Engineering instrumentation technology – E C Ramsay.
- 3.** Process control instrumentation technology – C D Johnson.
- 4.** Industrial instrumentation – D P Eckman.
- 5.** Principle of industrial process control – D P Eckman.
- 6.** Instrumentation – F M Kirk and K N R Rimboi.
- 7.** Electrical measurement and measuring instruments – J B Gupta
- 8.** Electrical transducers for industrial measurement – P H Mansfield.
- 9.** Industrial instrumentation fundamentals – Austin E Fribance.
- 10.** Chemical instrumentation and process control – A Suryanarayan.

6364 INDUSTRIAL STOICHIOMETRY AND THERMODYNAMICS

T P C
3 3 4

AIMS

- To be able to understand the basic principle of Stoichiometry.
- To be able to analyze and solve problems on Industrial Stoichiometry.
- To be able to understand the thermo chemistry.
- To be able to understand the principle of thermodynamics.
- To be able to understand thermodynamic process and their application.
- To be able to understand thermodynamic cycle and their application.
- To be able to understand steam table and their uses in problem solving.
- To be understand heat engines.

SHORT DESCRIPTION

Industrial application of molecular units; Material balance without chemical reaction and involving chemical reaction; Energy balance of industrial process; Energy conservation in static process; Latent heat of phase change and heat balance; Enthalpy changes accompanying chemical reaction; Thermo chemistry; Scope of thermodynamics; Laws of thermodynamics; Thermodynamic process of perfect gases; Constant volume process; Constant pressure process; Isothermal process; Adiabatic process; Reversible process; Polytrophic process; Hyperbolic process; Free expansion process; Enthalpy and entropy; Formation and properties of steam table; Carnot cycle; Otto cycle; Diesel cycle; Heat engines; Four stroke cycle engines; Two stroke cycle engines.

DETAIL DESCRIPTION

Theory:

1. Understand the industrial application of molecular unit.

- 1.1 Define gram atom, kilogram atom, gram mole and kilogram mole.
- 1.2 Explains Avogadro's hypothesis.
- 1.3 Describe Boyle's law & Charles law.
- 1.4 Explain the combination of Boyle's law and Charles' law.
- 1.5 Deduce the formula $PV=mRT$.
- 1.6 Solve the problems related to Boyle's law and Charles' law.

2 Understand the material balance without chemical reaction.

- 2.1 Define material balance.
- 2.2 Mention the law of conservation of material balance.
- 2.3 Describe the overall material balance.
- 2.4 Mention the importance of drawing flow chart of the process.
- 2.5 Describe the individual material balance.
- 2.6 Solve the problems of material balance in a process where materials entering and leaving without chemical reaction.

3 Understand the material balance involving chemical reaction in the process.

- 3.1 Define limiting reactants and excess reactants.

- 3.2 Describe the material balance involving chemical reaction.
- 3.3 Solve the problems of material balance involving chemical reaction by applying the concepts of stoichiometric reaction and PVT relations.
- 3.4 Solve the stoichiometric problems of material balance involving chemical reactions, molecular units and PVT relations.

4 Understand the energy balance of industrial process.

- 4.1 Define energy balance.
- 4.2 Describe the law of conservation of energy.
- 4.3 Mention the units of energy.
- 4.4 Explain internal and external energy.
- 4.5 Discuss energy balance in flow process.
- 4.6 Solve the problems of energy balance in flow process.

5 Understand the energy conservation in static process and the specific heats.

- 5.1 Mention the energy conservation in static process.
- 5.2 Describe specific heat at constant pressure and specific heat at constant volume.
- 5.3 Explain the relation between specific heat at constant pressure and specific heat at constant volume.
- 5.4 Mention the ratio of specific heats.
- 5.5 Express the deduction of the following formula:

$$\Delta E = Q - W$$

$$\Delta E = Q_V$$

$$\Delta E = Q_P - P\Delta V$$

$$Q_P = H_B - H_A = \Delta H = \Delta E + P\Delta V$$

- 5.6 Express the deduction of the formula

$$\Delta H = Q_P = mc_p(t_2 - t_1)$$

- 5.7 Solve stoichiometric problems related to enthalpy, internal energy and work done.

6. Understand latent heat of phase change and heat balance.

- 6.1 State latent heat of fusion and latent heat of solidification.
- 6.2 Describe latent heat of evaporation and latent heat of condensation.
- 6.3 Explain the heat balance in a flowing system.
- 6.4 Solve the problems of heat balance related to specific heat, latent heat of fusion and latent heat of evaporation.

7. Understand thermo chemistry.

- 7.1 Mention the heat of reaction and standard heat of reaction.
- 7.2 Mention the effect of temperature on heat of reaction.
- 7.3 Describe heat of formation and heat combustion.
- 7.4 Explain heat of neutralization and heat of solution.

- 7.5 Calculate the standard heat of reaction of a given chemical reaction whose heat of Formation of the reactants at 25°C and 1 atmospheric pressure is given.
- 7.6 Calculate the standard heat of reaction of a given chemical reaction whose heat of Combustion of the reactants at 25°C and 1 atmospheric pressure is given.
- 7.7 Discuss the heat of reaction of a given chemical reaction when the temperature of the reactants entering the system and the temperature of the product leaving the system are equal.

8 Understand the scope of thermodynamics.

- 8.1 Define thermodynamics.
- 8.2 Explain application and importance of thermodynamics.
- 8.3 Describe thermodynamic system.
- 8.4 State the law of conservation of energy.
- 8.5 Describe mechanical equivalent of heat.
- 8.6 Define thermal capacity
- 8.7 Describe water equivalent.

9. Understand the law of thermodynamics.

- 9.1 Define Zeroth law of thermodynamics.
- 9.2 Illustrate first law of thermodynamics.
- 9.3 Illustrate second law of thermodynamics.
- 9.4 Explain third law of thermodynamics.

10 Understand thermodynamic process.

- 10.1 State thermodynamic process.
- 10.2 List the various thermodynamic processes.
- 10.3 Illustrate briefly each of the thermodynamic process.
- 10.4 Define enthalpy & entropy.
- 10.5 Explain entropy enthalpy diagram.
- 10.6 Mention the relation between heat and entropy.

11 Understand the concept of constant volume process and constant pressure process.

- 11.1 Illustrate with P-V diagram for gas when gas heated at constant volume.
- 11.2 Explain the work done by the constant volume process.
- 11.3 Solve the problems at constant volume process.
- 11.4 Illustrate with P-V diagram for gases when heated at constant pressure process.
- 11.5 Explain work done by the gas when heated at constant pressure process.
- 11.6 Solve problems on constant pressure process.

12 Understand the concept of isothermal process and adiabatic process.

- 12.1 Illustrate with P-V diagram for gases when heated at constant temperature.
- 12.2 Explain work done by the gas when heated at constant temperature.
- 12.3 Define adiabatic (isentropic) process.
- 12.4 Illustrate with P-V diagram the adiabatic expansion process of gas.

- 12.5 Explain work done by the gas during adiabatic expansion process.
 - 12.6 Define reversible and irreversible process.
 - 12.7 Solve the problems on constant temperature process & adiabatic process.
- 13 **Understand the concept of polytropic process and hyperbolic expansion process.**
- 13.1 State polytropic process.
 - 13.2 Draw P-V diagram during the expansion of a gas on $PV^n = \text{constant}$.
 - 13.3 Explain the work done by the gas during the expansion on $PV^n = \text{constant}$.
 - 13.4 State hyperbolic process.
 - 13.5 Draw and explain P-V diagram of hyperbolic expansion process.
 - 13.6 Explain work done by the gas during hyperbolic expansion process.
- 14 **Understand the formation and properties of steam.**
- 14.1 Define steam and vapor.
 - 14.2 Explain the terms wet steam, dry steam, saturated steam, super heated steam, dryness fraction of wet steam, sensible heat of water.
 - 14.3 Explain steam table and their uses.
 - 14.4 Calculate total heat content in hot and superheated steam.
 - 14.5 Explain Mollier diagram.
- 15 **Understand the concept of Carnot cycle.**
- 15.1 Define thermodynamic cycle.
 - 15.2 Explain P-V diagram for Carnot cycle.
 - 15.3 Explain working principle of Carnot cycle.
 - 15.4 Compute the efficiency of Carnot cycle.
 - 15.5 Solve problems on efficiency of Carnot cycle.
16. **Understand the concept of Otto cycle and Diesel cycle.**
- 16.1 Describe Otto cycle.
 - 16.2 Draw P-V diagram for Otto cycle.
 - 16.3 Explain working principle of Otto cycle with the help of P-V diagram.
 - 16.4 Describe Diesel cycle.
 - 16.5 Draw P-V diagram of Diesel cycle.
 - 16.6 Explain the working principle of Diesel cycle with P-V diagram.
- 17 **Understand the concept of heat engine.**
- 17.1 Define heat engine.
 - 17.2 Describe internal and external combustion engine.
 - 17.3 Compare between internal and external combustion engine.
 - 17.4 Explain the terms of cylinder, cylinder head, piston, piston ring, crank shaft, connecting rod, crank case, flywheel, T.D.C, B.D.C, stroke, stroke length, stroke volume, clearance volume, full cylinder volume, compression ratio.
- 18 **Understand the four stroke and two stroke cycle engines.**
- 18.1 Explain four stroke cycle petrol engines.
 - 18.2 Explain four stroke cycle diesel engines.
 - 18.3 Distinguish between petrol and diesel engine.
 - 18.4 Explain two –stroke cycle petrol engines.

- 18.5 Explain two- stroke cycle diesel engine.
18.6 Explain advantages and disadvantages of two-stroke over four stroke engines.

Practical:

1. Practice in solving stoichiometric problems on molecular units.
2. Practice in solving stoichiometric problems on material balance.
3. Practice in solving stoichiometric problems on energy balance of industrial process.
4. Practice in solving stoichiometric problems on specific heat.
5. Practice in solving stoichiometric problems on latent heat of fusion and evaporation.
6. Practice in solving stoichiometric problems on heat of reaction and heat of formations.
7. Practice in solving stoichiometric problems on thermochemisrty.
8. Determine the integral heat of solution of potassium nitrate in water.
9. Determine heat of neutralization of hydrochloric acid with sodium hydroxide.
10. Determine the melting point of organic substance (i.e. wax, oxalic acid, urea e.t.c.).
11. Determine the specific heat of a number of materials (i.e. water, kerosene, petrol, glycerin etc).
12. Determine the calorific value of a fuel by using bomb calorimeter.
13. Demonstrate the working principle of a 4 stroke Otto and 4 stroke diesel cycle using model.
14. Demonstrate the working principle of a 2 stroke Otto and 2 stroke diesel cycle using model.

Reference books:

1. Engineering Thermodynamics
-R.S. Khurmi.
2. Principle of Chemical Engineering Thermodynamics.
- Wilson and Rics.
3. Chemical Engineering Thermodynamics
- Doge.

AIMS:

- ❖ To be able to understand the basic theory involved in Radiant energy, Photometry, Spectro photometry, Fluorometry, Refractometry, Polarimetry, p^H measurement and Gas Chromatography.
- ❖ To be able to operate and maintain the p^H meter. Spectrophotometer, Polarimeter Refractometer, Flame photometer, Fluorometer and Gas chromatograph.

SHORT DESCRIPTION:

Spectral distribution to radiant energy and its application in instrumental methods of analysis photometry and spectro photometry; Flame photometry and its application in the instrumental Methods of analysis; Fluorometry and its application in chemical analysis; Refractometry and its application in chemical analysis, polarimetry and its application in chemical analysis, principles of electrochemical methods and their application in chemical analysis; Methods of electrometric measurement of p^H ; Gas Chromatography:

DETAILED DESCRIPTION**Theory****1. RADIANT ENERGY:**

Understand the spectral distribution of radiant energy and its application in the instrumental methods of analysis.

- 1.1 Define radiant energy.
- 1.2 List the source of radiant energy.
- 1.3 Draw the spectral distribution curve of radiant energy sources.
- 1.4 List the special components of filter photometer.
- 1.5 Draw schematic diagram of a spectro photometer and colorimeter.
- 1.6 Discuss the photo sensitive detectors and dispersing devices.
- 1.7 Find the relationship between velocity, wave length and wave number to the Frequency.

2. FLAME PHOTOMETRY

Understand the Flame Photometry and Spectro Photometry.

- 2.1 Define flame photometry.
- 2.2 Describe Buogar's Lambert's law and Beer's Law.
- 2.3 Describe the working principle of a flame photometry diagrammatically.
- 2.4 Describe the working principle of spectro photometry diagrammatically.

- 2.5 Discuss the uses of colorimeters and spectro photometers in chemical and food industry.
- 2.6 Find the relation among percent transmittance, absorbance and concentration of substance.
- 2.7 Describe the deviations from Beer's law.
- 2.8 Discuss the uses of a flame photometry in the instrumental methods of chemical analysis.

3. FLUOROMETRY

Understand the principle of fluorometry and its application in chemical analysis.

- 3.1 Define fluorometry.
- 3.2 Define fluorescence and phosphorescence.
- 3.3 Explain Quenching, self Quenching and chemical Quenching.
- 3.4 Describe the working principle of filter Fluorometer.
- 3.5 Discuss the uses of Ramon spectroscopy.
- 3.6 Mention the uses of filter Fluorometer in the analysis of chemicals.
- 3.7 Discuss fluorescence intensity as related to concentration.

4. REFRACTOMETRY

Understand the principle of Refractometry and its application in chemical analysis.

- 4.1 Define refractive index or Index of refraction.
 - 4.2 Describe the two laws of refraction.
 - 4.3 Explain degree Brix and TSS (Total soluble solid).
 - 4.4 Define refraction of light.
 - 4.5 Define index to refraction of two different medium.
 - 4.6 Describe the working principle of the Abbe and the immersion Refractometer diagrammatically.
 - 4.7 Describe the working principle of Hand Refractometer diagrammatically.
 - 4.8 Discuss the uses of the Refractometer in chemical and food industry.
 - 4.9 Solve the problems.
- Specific refraction and molar refraction of Carbon Tetra Chloride & Acetic Acid.

5. POLARIMETRY

Understand the principle of polarimetry and its application in chemical and food industry.

- 5.1 Define Polarization of Light and Polarized Light.
- 5.2 Define optical rotation of light.
- 5.3 Define specific rotation.
- 5.4 Define Mutarotation and Recimization.
- 5.5 Describe the principle of polarimetry.
- 5.6 List the component of a polarimeter.
- 5.7 Describe the working principle of Polarimeter diagrammatically.
- 5.8 Discuss the uses of Polarimeter in chemical analysis.
- 5.9 Calculate the specific rotation and concentration of sucrose solution using Polarimeter

5.10 Define Prism and Describe the working principle of different types of prism by diagrammatically.

6. ELECTRO CHEMICAL METHODS

Understand the principle of electro-chemical and their application in chemical analysis.

6.1 Define electrolytes and electrolysis.

6.2 Define electrode.

6.3 Define reference and inert electrode.

6.4 Describe the working principle of the following electrodes.

a) Glass electrode.

b) Calomel electrode.

c) Hydrogen gas electrode.

d) Silver-silver chloride electrode.

6.5 Define potentiometer.

6.7 Describe the working principle of potentiometric titration diagrammatically.

6.8 List the instruments used for the measurement of electrode potential.

6.9 List the methods of potentiometric titration.

7. P^H MEASUREMENT

Understand the methods of electrometric measurement of p^H value.

7.1 Define P^H and P^{OH}

7.2 Define buffer solution and standard buffer solution.

7.3 List the ten buffer solution with their p^H range

7.4 Define indicators.

7.5 List 5 indicators with their p^H range.

7.6 Draw the circuit diagram of a direct reading p^H meter.

7.7 Discuss the theory of indicators behavior.

7.8 Describe the working principle of a direct reading p^H meter diagrammatically.

7.9 Describe the method of determination of pH by color comparison.

8. GAS CHROMOTOGRAPHY

Understand the principle of gas chromatography.

8.1 Define gas chromatography.

8.2 Define carrier gas.

8.3 Define retention time and retention volume.

8.4 Describe the principle of chromatography.

8.5 Define TCD and ECD.

8.6 Draw a simple schematic diagram of a gas chromatography.

8.7 Describe the working principle of paper chromatograph.

8.8 Draw a simple schematic diagram of a liquid chromatography.

8.9 List the uses of gas chromatograph in the analysis of chemicals.

AIMS

- To be able to understand the basic concepts of environment and environmental pollution.
- To be able to understand the concepts of ecology, ecosystems, global environmental issues, air pollution, water pollution, soil pollution, radioactive pollution, sound pollution, etc.
- To be able to understand the methods of controlling air pollution, water pollution and sound pollution.
- To be able to understand the management of waste, soil and pesticide pollution and
- To be able to understand the major environmental issues and problems in Bangladesh.

SHORT DESCRIPTION

Basic concepts of environment; Ecology & eco-systems; global environmental issues Air and atmospheric layers; Air pollution sources & effects; climate change, green house effect and depletion of ozone layer; Control of air pollution; Water pollution sources & effects; Monitoring of water pollution; Waste water treatment; Sound pollution and its control; Soil pollution and its management; Radioactive pollution and its control; Solid waste management; Major environmental issues and disaster management- Arsenic pollution; Pesticides pollution and its management, Environmental legislations and guidelines frame work and policy in Bangladesh.

DETAIL DESCRIPTION**1. Understand the basic concepts of environment.**

- 1.1 Define: environment, Marine environment, Freshwater environment, Nutrients, Mangrove forest, Photo-chemical oxidant, Pollutant, Receptor, Sink, Pathways of pollutant, Speciation.
- 1.2 Mention the main components of environment.
- 1.3 Mention the functions of environment.
- 1.4 Describe natural environment, man-made environment and social environment.

2. Understand ecology and eco-systems.

- 2.1 Define ecology and eco-system.
- 2.2 Mention the range of tolerance in eco-system.
- 2.3 Explain the biotic and abiotic components of eco-system.
- 2.4 Explain briefly how does eco-system work.
- 2.5 Explain the stability of eco-system.
- 2.6 Explain the following ecological terms:
Food chain, Food web, Biodiversity, Biomass, Ecological pyramid, Pyramid of biomass, Pyramid of energy, Bio-concentration, Bio-magnification, Restoration ecology.
- 2.7 Narrate the following bio-geochemical cycles of eco-system.
 - a) Carbon cycle
 - b) Nitrogen cycle
 - c) Phosphorus cycle
 - d) Sulphur cycle.
 - e) Hydrologic cycle
- 2.8 Describe the following global environmental issues: Global environment, Earth and other environmental summits, climate change and ozone layer depletion.

3. Understand the air and the atmospheric regions.

- 3.1 Mention different layers of atmosphere.
- 3.2 Mention the average composition of the atmosphere at sea level.

- 3.3 Describe the chemical species and particulates present in the atmosphere.
- 3.4 Describe the importance ozone layer.

4 Understand the air pollution and its sources & effects.

- 4.1 Define air pollution.
- 4.2 Mention the composition of clean dry atmospheric air.
- 4.3 List the air pollutants.
- 4.4 Identify the sources of air pollutions.
- 4.5 List the green house gases.
- 4.6 Mention the effects of air pollution on human health, animals, plants and non-living things.
- 4.7 Explain the formation of photo-chemical smog and its effect.
- 4.8 List the disasters of major air pollution in the world mentioning location, causes and effects.
- 4.9 Explain the causes of acid rain and its effect on eco-system.

5 Understand the control of air pollution at the sources.

- 5.1 Mention the methods of air pollution control.
- 5.2 Describe the following devices: gravitational settling chamber, cyclone separator, wet scrubber, centrifugal scrubber, fabric filter, catalytic converter.

6 Understand the sources of water pollution and its effects.

- 6.1 Define water pollution.
- 6.2 Mention the specification of ideal water as per recommendation of the World Health Organization (WHO).
- 6.3 List the different types of water pollutants.
- 6.4 Describe the sources of water pollution.
- 6.5 Describe the effects of water pollution on human health, animal, plants and environment.

7 Understand the monitoring of water pollution.

- 7.1 Define the following terms:
 - (i) Dissolved oxygen (DO).
 - (ii) Biochemical oxygen demand (BOD).
 - (iii) Chemical oxygen demand (COD).
 - (iv) Total organic carbon (TOC).
 - (v) Threshold limit value (TLV).
- 7.2 Mention the method of determination of pH value of water.
- 7.3 Mention the method of determination of dissolved oxygen (DO) in a sample of water.
- 7.4 Mention the method of determination of biochemical oxygen demand (BOD) in a sample of water.
- 7.5 Mention the method of determination of chemical oxygen demand (COD) in a sample of water.

8 Understand the waste water treatment.

- 8.1 Define the primary treatment, secondary treatment and tertiary treatment of waste water.
- 8.2 Define the following terms; ETP, Oxidation pond, waste stabilization pond, trickling filter, Activated slug.
- 8.3 Mention the methods of primary and secondary treatment of industrial waste water.

9 Understand the sound pollution and its control.

- 9.1 Define sound, sound wave and sound pollution.
- 9.2 Mention the scale of measuring sound intensity.
- 9.3 Mention the sources of sound pollution.
- 9.4 Describe the effect of sound pollution on human health.
- 9.5 Describe the methods of control of sound pollution.

- 10 Understand the soil pollution and its management.**
- 10.1 Define soil pollution.
 - 10.2 List the classification of soil pollution.
 - 10.3 Mention the sources of soil pollution.
 - 10.4 Describe the effect of soil pollution on human health.
- 11 Understand the radioactive pollution and its control.**
- 11.1 Define radioactive pollution.
 - 11.2 Mention the sources of radioactive pollution.
 - 11.3 List the causes of radioactive pollution.
 - 11.4 Explain the effect of radioactive pollution on human health.
 - 11.5 Describe the method of control of radioactive pollution.
- 12 Understand the solid waste management.**
- 12.1 Define solid waste.
 - 12.2 List the sources of solid waste.
 - 12.3 Mention the classification of solid waste.
 - 12.4 Mention the methods of collection of solid waste.
 - 12.5 Mention the waste management strategies in Bangladesh.
 - 12.6 Describe the recycling of solid wastes.
 - 12.7 Describe the potential method of disposal of solid waste.
- 13 Understand the major environmental issues in Bangladesh.**
- 13.1 List the major environmental issues in Bangladesh.
 - 13.2 Describe the following disaster management of Bangladesh flood, cyclone, tidal surge, Cyclone(SIDR, AILA, Nargis, Tsunami), landslide, earthquakes and salinity.
- 14 Understand the arsenic pollution in Bangladesh.**
- 14.1 Mention the arsenic pollution of water in Bangladesh.
 - 14.2 Explain the effects of arsenic pollution on human health.
 - 14.3 Describe the causes of arsenic in ground water.
- 15 Understand the pesticide pollution in Bangladesh and its management.**
- 15.1 Define pesticide.
 - 15.2 Make a list of pesticides.
 - 15.3 Mention the causes of pesticide pollution in Bangladesh.
 - 15.4 Describe the effect of pesticide pollution in the environment.
- 16 Understand the national environmental legislations and guidelines environmental frame work and policy in Bangladesh.**
- 16.1 Define, EA, EIA, IEA, NEMAP, DOE, BELA, GPS, GIS
 - 16.2 Mention environmental act and legislations prescribed for air and water quality.
 - 16.3 Describe environmental act prescribed for industries in Bangladesh.
 - 16.4 Describe the guide lines of environment prescribed for industries in Bangladesh.
 - 16.5 Describe the environmental frame work in Bangladesh.

REFERENCE BOOKS

১. পরিবেশ দূষণ (১ম ও ২য় খন্ড) – আবদুল মালেক ভূইয়া – গৌতম পাল
২. বিপন্ন পরিবেশ ও বাংলাদেশ – ডঃ এফ এম মনিরুজ্জামান
৩. বায়ু ও পানি দূষণ এবং প্রতিকার – মুহাম্মদ কাউছার হাবিব ভূইয়া
৪. পরিবেশ বিজ্ঞান – মুহাম্মদ কাউছার হাবিব ভূইয়া
৫. শব্দ ও তেজস্ক্রিয় দূষণ এবং প্রতিকার – মুহাম্মদ কাউছার হাবিব ভূইয়া
৬. মাটি ও তেজস্ক্রিয় দূষণ এবং প্রতিকার – মুহাম্মদ কাউছার হাবিব ভূইয়া
7. Pollution control in process industries – S. P. Mahajan
8. Environmental Engineering – Peavy, Rowe and Techobanglous
9. Air pollution – V. P. Kudesia
10. Industrial Noise Control – Bruce Fader
11. Pesticide Pollution – Kudecsia and Charaya
12. Water Pollution – V. P. Kudesia
13. Peoples Report on Bangladesh Environment 2001
Atia Rahman, M. Ashraf Ali and Farooque Choudhury

PRACTICAL

1. Find out the refractive index of the given samples of liquid using Abbe Refractometer.
2. Determine the thiamine or riboflavin by a Fluorimeter.
3. Find out the specific rotation of cane sugar and also find out the concentration of the unknown solution of sucrose using by polarimeter.
4. Find out the percentage d-sugar in a given solution polar imetrically.
5. Find out the p^H value of unknown solution using a p^H meter.
6. Find out p^H value of unknown given solution sample using by p^H paper.
7. Find out the strength of given hydrochloric acid solution on (approximate strength $N/10$) by titrating it against sodium hydroxide solution by a burette.
8. Find out the strength of acetic acid by titrating it against sodium hydroxide potentiometriclly (the appropriate strength of the acid is $N/10$ solution)
9. Find out the strength of $AgNO_3$ solution by titrating it with KCl solution by the different titrating technique using potentiometer.
10. Draw the schematic diagram of a gas chromatograph and level its important parts.
11. Determine the melting point of dalda by thermo metric method.
12. Find out gluten percentage of flour manually process. (Method)
13. To Measure the F.F.A value of olic acid by titrating methods.

REFERENCE BOOKS

1. Instrumental Methods of Analysis - Willard, Meritt, D. Vas Norstand Company, New York, Toronto, London.
2. Introduction to instrumental Analysis - Ewing.
3. Chemical analysis an instrumental approach - A.K. Srivastava.
4. Advance experimental chemistry - J.N Gupta and R. Kapoor.
5. Advance practical chemistry vol - I and vol-II- B.S Bahl and A.N Sharma. Sahand and Company, New Delhi.

AIMS

- To be able to develop the working condition in the field of industrial or other organization.
- To be able to understand develop the labor management relation in the industrial sector.
- To be able to develop the management techniques in the process of decision making.
- To be able to manage the problems created by trade union.
- To be able to understand the network , PERT, CPM & MBO
- To be able to perform the marketing.
- To be able to maintain inventory.

SHORT DESCRIPTION

Basic concepts of management; Principles of management; Scientific management; Organization; Span of supervision; Motivation; Personnel management and human relation; Staffing and manpower planning ; Training of staff; Industrial dispute; Concept of leadership; Concepts and techniques of decision making; Concept of trade union; Inventory control; Economic lot size ; Break even analysis; Labour and industrial law; PERT , CMP ; Network ; Marketing; Production management;

1 Understand the basic concepts & principles of management.

- 1.1 Define management and industrial management.
- 1.2 State the objectives of modern management.
- 1.3 Describe the scope and functions of management.
- 1.4 State the principles of management.
- 1.6 State the activity level of industrial management from top personnel to workmen.
- 1.7 Describe the relation among administration, organization & management.
- 1.8 Define Production Management and functions of Production Management.
- 1.9 Explain the social responsibilities of management.

2 Understand the concept of scientific management.

- 2.1 Define scientific management.
- 2.2 Discuss the basic principles of scientific management.
- 2.3 Explain the different aspects of scientific management.
- 2.4 Discuss the advantages and disadvantages of scientific management.
- 2.5 Describe the difference between scientific management and traditional management.
- 2.6 Describe the following four periods of management thought:
 - (i) pre-scientific management.
 - (ii) scientific management.
 - (iii) human relations
 - (iv) refinement extension and synthesis of management theories and practices.

3 Understand the concepts of organization and organization structure.

- 3.1 Define management organization.
- 3.2 State the elements of management organization.

- 3.3 Discuss the types of organization structure
- 3.4 Describe different forms of organization structure.
- 3.5 Distinguish between line organization and line & staff organization.
- 3.6 Distinguish between line organization and functional organization.
- 3.7 Describe the feature advantages and disadvantages of different organization structure.
- 3.8 Define organizational chart.
- 3.9 Describe the different types of organizational chart.

4 Understand the basic concept of span of supervision.

- 4.1 Define span of supervision and optimum span of supervision.
- 4.2 Discuss the considering factors of optimum span of supervision.
- 4.3 Discuss advantages and disadvantages of optimum span of supervision.
- 4.4 Define delegation of authority.
- 4.5 Explain the principles of delegation of authority.
- 4.6 Explain the terms: authority, responsibility and duties.

5 Understand the concept of motivation.

- 5.1 Define motivation.
- 5.2 Discuss the importance of motivation.
- 5.3 Describe financial and non-financial factors of motivation.
- 5.4 State the motivation process or cycle.
- 5.5 Discuss the motivation theory of Maslows and Harzbergs.
- 5.6 Differentiate between theory-X and theory-Y.
- 5.7 Discuss the relation between motivation and morale.

6 Understand the concept of leadership.

- 6.1 Define leadership.
- 6.2 Discuss the importance and necessity of leadership.
- 6.3 Discuss the functions of leadership.
- 6.4 Identify the types of leadership.
- 6.5 Describe the qualities of a leader.
- 6.6 Distinguish between autocratic leader and democratic leader.

7 Understand the basic concepts and techniques of decision making.

- 7.1 Define decision making.
- 7.2 Discuss the importance and necessity of decision making.
- 7.3 Discuss different types of decision making .
- 7.4 Describe the steps in decision making.

8 Understand the concept of personnel management and human relation.

- 8.1 Define personnel management.
- 8.2 Discuss the importance of personnel management.
- 8.3 Discuss the functions of personnel management.
- 8.4 Define staffing.
- 8.6 Define recruitment and selection of employees.
- 8.7 Describe various sources of recruitment of employees.
- 8.8 Describe the various methods of selection of employees.
- 8.9 Discuss the advantages and disadvantages of internal sources of recruitment.
- 8.10 Discuss the disadvantages of external sources of recruitment.
- 8.11 Define training and orientation of employee.
- 8.12 Discuss the importance and necessity of training.
- 8.13 Discuss the various methods of training of workmen, technicians and executive personnel.

9. Understand the concept of inventory control

9.1 Define inventory.& inventory control.

9.2 Describe the function of inventory control.

9.3 Discuss the necessity and importance of inventory control.

9.4 Mention the advantages and disadvantages of inventory control.

9.5 Explain the following terms :

- Bin card or Bin tag.
- Purchase requisition.
- Store requisition.
- Material transfer note.
- First in first out (FIFO).
- Last in first out(LIFO).
- PERT
- CPM
- NETWORK
- MBO

10 Understand the concept of economic lot size & break even analysis

10.1 Define economic lot size.

10.2 Discuss the effects of over supply and under supply.

10.3 Describe the method of determination of economic lot size.

10.4 Explain the terms :

- Safety stock
- Determination of safety stock
- Lead time

10.5 Define break even point and break even chart.

10.6 Explain the terms :

- Break even analysis.
- Fixed cost.
- Variable cost.

10.7 Discuss the importance of break even analysis.

10.8 Describe the method of preparing break even chart.

10.9 Describe different methods of break even analysis.

10.10 Draw break even chart in different method.

10.11 Mention the advantages and disadvantages of break even analysis.

11 Understand the concept of Marketing and inventory control

11.1 Define marketing.

11.2 Discuss the function of marketing.

11.3 State the objectives of marketing.

11.4 Explain the terms :

- Brand
- Producer
- Consumer
- Customer
- Copyright
- Trade mark

11.5 Discuss product life-cycle and marketing strategies in different stages of a product life-cycle

11.6 Define purchasing

11.7 Describe the five "R" of purchasing principles

12 Understand the concept of trade union and industrial law

12.1 Define trade union.

12.2 Mention the objectives of trade union.

- 12.3 Discuss the function of trade union.
- 12.4 Describe different types of trade union.
- 12.5 Mention the names of major trade union in Bangladesh.
- 12.6 Define labour and industrial law.
- 12.7 Discuss the importance of labour and industrial law.
- 12.8 Explain the terms :
- Factory Act. (1965)
 - Minimum Wage Act (1957).
 - Industrial Disputes Act.
 - Work Men Compensation Act.
 - Trade Union Act.