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

FOOD TECHNOLOGY
TECHNOLOGY CODE: 69

SYLLABUS
(PROBIDHAN-2016)

FIRST SEMESTER
## Food Technology
### 1st Semester

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OBJECTIVES
To provide the students with an opportunity to acquire knowledge and skill:

- To make understand Basic concept of food engineering.
- To develop the Basic knowledge of unit operation & unit process.
- To be able to draw the schematic representation of the different food plants equipments.
- To be able to identify food engineering field.
- To be able to understand units, dimension, conversion factor and heat transfer in food sector.
- To be able to understand hand tools.
- To be able to understand pipe and pipe fittings.
- To be able to understand mixture and solution.
- To be able to understand food safety, Hazard.

SHORT DESCRIPTIONS
Food engineering; Composition of food; Unit operation and unit process; Food process industries; Process symbol, Units and dimension; Conversion factor; Heat transfer; Hand tools, Pipe; Pipe fittings; Food safety; PPE, OSH, Accident, Hazard; Mixture; Solution.

DETAILED DESCRIPTION:
Theory:

1. Understand the general concept of food engineering.
   1.1 Define Food Engineering and Food Technology.
   1.2 Responsibility of food engineer.
   1.3 Explain the role of food engineers for the development in the country.
   1.4 State food process industry.
   1.5 Make a list of important food process industries in Bangladesh.

2. Classification and composition of foods.
   2.1 Define food.
   2.2 State the composition of foods.
   2.3 Define plant foods and animal foods.
   2.4 State classification of plant foods.
   2.5 State classification of animal foods.

3. Understand the concept of unit operations and unit processes.
   3.1 Define unit operation and unit process.
   3.2 Make a list of important unit operations related to the food process industries.
   3.3 Explain the following unit operations;
      i) Crystallization
      ii) Pasteurization
      iii) Filtration
      iv) Sterilization
      v) Mixing
      vi) Size reduction
      vii) Emulsification
      viii) Extraction
      ix) Distillation
      x) Homogenization
3.4 Explain the following unit processes;
   i)  Alkylation
   ii) Hydrogenation
   iii) Oxidation
   iv) Dehydration
   v)  Nitration
   vi) Hydration
   vii) Halogenations
   viii) Polymerization

4. Understand the process symbols applied to food process industries.
   4.1 Define process symbol.
   4.2 Explain the process symbols with diagram applied to food process industries.
   4.3 Identify instrumental symbol with diagram applied to food process industries.
   4.4 Identify the electrical symbols with diagram applied to food process industries.
   4.5 Mention the significance of process symbols applied to food process industries.

5. Understand the schematic representation of food plant units and equipment.
   5.1 Make a list of important food plants and equipments.
   5.2 Draw the schematic representation of following;
      i)  Spray drier
      ii) Rotary drier
      iii) Tunnel drier
      iv) Liquid extraction unit
      v)  Open pan evaporator
      vi) Multiple effect evaporator
      vii) Centrifugal pump
      viii) Pneumatic conveyor
      ix) Screw conveyor
      x)  Belt conveyor
      xi) Bucket elevators
      xii) Shell and tube heat exchangers.

6. Understand units and dimensions.
   6.1 Define units and dimensions.
   6.2 State the objectives of units and dimensions.
   6.3 Units of measurement and dimensions.
   6.4 Describe systems of units.
   6.5 Explain the dimensional equation.

7. Understand the conversion factor, mass and energy balance.
   7.1 Define conversion factor.
   7.2 State the objectives of conversion factor.
   7.3 Solve the problems of conversion factors from one unit to another unit (such as mass, volume, pressure, force and energy).
   7.4 Define mass and energy balance.
   7.5 Application of mass and energy balance in food engineering operations.
   7.6 Solve the problems of mass and energy balance.

8. Understand Heat & Heat transfer.
8.1 Define heat and temperature.
8.2 Describe scales of temperature.
8.3 Define heat transfer.
8.4 State the classification of heat transfer.
8.5 Mechanisms of heat transfer.
8.6 Explain steady state and unsteady state heat transfer.
8.7 Explain thermal processing of foods.

9. Understand the application of common hand tools used in the food process industries.
9.1 Define cutting, striking, holding and measuring tools.
9.2 List the cutting, striking, holding and measuring tools commonly used in food process industries.
9.3 Mention the function of cutting, striking, holding and measuring tools commonly used in food process industries with diagram.

10. Understand the features of pipes and pipe fittings.
10.1 Define pipe and pipe fittings.
10.2 List commonly used pipe fittings.
10.3 Explain the uses of important pipe fittings.
10.4 Design a pipe structure using different types of pipe fittings.
10.5 List commonly used pipe fittings symbol with diagram.

11. Understand the basic concept of safety and hazard in the food industry.
11.1 Define safety.
11.2 Explain safety symbol and color code.
11.3 Explain personal protective equipment (PPE), Occupational safety and health (OSH).
11.4 Explain the safety procedure and practice in modern food industry.
11.5 Explain fist aid and first aid box.
11.6 Define accident and hazard.
11.7 Explain the hazard check list.

12. Understand solutions and mixtures
12.1 Define solution and mixtures.
12.2 State the objectives of study and calculations of solutions and mixtures.
12.3 Explain solubility.
12.4 Describe concentration of solution and mixtures.
12.5 Calculations related to solution and mixture.

PRACTICAL:
1. Show skill in drawing the process symbols and diagrams.
2. Show skill in drawing the schematic representation of the following food plants;
   2.1 Spray drier
   2.2 Rotary drier
   2.3 Tunnel drier
   2.4 Multiple effect evaporator
   2.5 Shell and tube heat exchangers
   2.6 Filter press.
3. Practice in solving Stoichiometric dimensions and conversion of units.
4. Practice in solving conversion of temperature from one scale to another.
5. Practice in solving Conversion of pressure from one form of unit to another (such as dyne/cm$^2$ to PSI, Nm$^2$, cm Hg, ft of water and vice versa).
6. Show skill in physical identification and practical demonstration of the use of hand tools.
7. Show skill in identifying the different pipe fittings and write their uses with diagram.
8. Show skill in making a piping structure by cutting threads and connecting pipe fittings.
9. Practice in solving concentration of solution (such as mass%; mole%; molality; morality; normality etc.)
10. Identify the hazard in work place.

REFERENCE BOOKS

1. Fundamentals of food process engineering. by Romeo T. Toledo.
2. Introduction to Food Engineering by R.P. Singh & D.R. Heldman
3. Unit operation in food processing. by R.L. Earle with M.D. Earle
   (www.nzifst.org.nz/unitoperation/index)
6. An Introduction to Chemical Engineering by C.E Little John.
7. Basic Stoichometry by BTEB.
8. Introduction to Food Engineering by R.P. Singh & D.R. Heldman
ENGINEERING DRAWING

OBJECTIVES

- To develop the ability to use various drawing instruments and materials.
- To enable in constructing and using various types of scales in drawing.
- To provide the ability to construct various geometrical figures.
- To enable to adopt various symbols used in drawing.
- To understand the orthographic and isometric projection.

SHORT DESCRIPTION

Drawing instruments and their uses; Lettering, numbering and constructing title strip; Adopting alphabet of lines and dimensioning; Constructing scales; Constructing geometrical figures; Constructing conic sections; Adopting symbols; Views and isometric projections.

DETAIL DESCRIPTION

DRAWING INSTRUMENTS AND MATERIALS

1 Practice with drawing instruments and materials for basic drawing technique.
   1.1 Identify the different types of drawing instruments.
   1.2 Use different types of drafting equipment.
   1.3 Use different types of draughting software.
   1.4 Identify the standard sizes of drawing board and sheets.
   1.5 Draw the border lines in drawing sheets following standard rule.
   1.6 Draw horizontal, vertical and inclined lines with the help of set squares and T-square.
   1.7 Draw 15 degree, 75 degree, 105 degree and 120 degree angles with the help of set squares.
   1.8 Use lettering guide, template, scale pantograph and French curve.

LETTERING NUMBERING AND TITLE STRIP

2 Letter and number freehand and with instruments.
   2.1 Identify the necessity of good lettering in engineering drawing.
   2.2 Draw freehand single stroke vertical letters from A to Z (upper and lower case) and numbers 0 to 9.
   2.3 Draw freehand inclined (65 degree to 75 degree) single stroke letters from A to Z (upper and lower case) and numbers from 0 to 9.
   2.4 Draw block letters (Gothic) using 5: 4 and 7: 5 proportions and height.
   2.5 Select a suitable size of letters and write a few sentences using all the letters selecting suitable scale.
   2.6 Draw title strip with proper placement using suitable size of letters and measurements.

ALPHABET OF LINES AND DIMENSIONING

3 Adopt the alphabet of lines.
   3.1 Select different lines in drawing.
   3.2 Use center line, hidden line, phantom line, break line, dimension line, extension line, section line and cutting plane line.
3.3 Use different thickness of line to emphasize a part of drawing.
3.4 Select recommended grades of pencils for various types of lines for engineering drawing.

4 Adopt the elements and theory of dimensioning.
4.1 Put dimensions in engineering drawing according to an accepted standard.
4.2 Identify the elements of dimensions from a given dimensioned drawing.
4.3 Apply aligned and unidirectional system of dimensioning.
4.4 Draw size and location of dimension, continuous dimension, staggered dimension and dimensioning in limited space.
4.5 Add necessary dimension to a given drawing with suitable arrows.

CONSTRUCTION OF SCALE
5 Prepare scale for drawing application.
5.1 Calculate representative fraction and interpret a scale reading.
5.2 Use different types of scale to find full size dimension.
5.3 Draw a plain scale to show meters, centimeters and millimeters of a given distance on object.
5.4 Draw a diagonal scale to show three units having given RF.
5.5 Read particular distance on plain and diagonal scale.
5.6 Use scale of chord.
5.7 Draw angle of 49 degree, 78 degree and 95 degree with the help of scale of chord.

GEOMETRICAL CONSTRUCTIONS & CONIC SECTIONS
6 Construct geometric figures (regular polygons) & Construct conic sections.
6.1 Draw regular polygons i.e. pentagon, hexagon and octagon having given one side.
6.2 Draw an ellipse by concentric circle method.
6.3 Draw an ellipse by parallelogram method.
6.4 Draw an ellipse by four center method.
6.5 Draw a parabola having given foci and director.
6.6 Draw a parabola from given abscissa and ordinate.

SYMBOLS
7 Adopt standard symbols in drawing.
7.1 Identify symbols used in drawing.
7.2 Draw a legend using symbols of different engineering materials.
7.3 Draw the symbols of different plumbing fittings and fixtures used in drawing.
7.4 Draw the symbols of different electrical fittings and fixtures used in drawing.
7.5 Interpret information from drawing containing standard symbols.

8. Understand the views of engineering drawing.
8.1 Identify different types of views
8.2 Interpret different types of views

9 Apply the Principles of orthographic projection to a straight line.
9.1 Draw the orthographic projection of a straight line under the following conditions :
   a) Line parallel to both planes
   b) Line perpendicular in vertical plane and parallel to horizontal plan
   c) Line parallel to vertical plane and perpendicular to horizontal plane
   d) Line inclined at given angle to horizontal plane and parallel to vertical plane
e) Line inclined at given angle to vertical plane and parallel to horizontal plane

10 Apply the principles of orthographic projection of rectangular and circular planes (Lamina)
   10.1 Draw the orthographic projection of rectangular lamina Parallel to both planes.
   10.2 Draw the orthographic projection of rectangular lamina inclined at given angle to horizontal plane.
   10.3 Draw the orthographic projection of circular lamina parallel to both planes.

11 Apply the principles of orthographic projections of geometric solids
   11.1 Draw the orthographic projection of a cube kept at an angle with one of the planes in first angle method.
   11.2 Draw the orthographic projection of a pyramid kept at an angle with both the planes in 1st angle method.
   11.3 Draw the orthographic projection of a cone kept at an angle with both the planes in third angle method.
   11.4 Draw the orthographic projection of a prism kept at an angle with vertical plane in third angle method.

ISOMETRIC PROJECTION

12 Understand the importance, use and scope of isometric views in engineering.
   12.1 Identify isometric views.
   12.2 Draw the isometric view of rectangular and circular lamina.
   12.3 Draw the isometric projection of solids such as: cube, cylinder, pyramid, prism and steps from different orthographic views.
   12.4 Draw the isometric projection of three deterrent engineering parts from orthographic views.

REFERENCE BOOKS
1 Geometrical Drawing - I H Morris
2 Prathamic Engineering Drawing - Hemanta Kumar Bhattacharia
3 Civil Engineering Drawing - Guru Charan Singh
উদ্দেশ্য:
1. মাতৃভাষা হিসেবে বাংলা ভাষার প্রকৃতি ও বৈশিষ্ট্য সম্পর্কে ধারণা লাভ। ভাষার ব্যবহারে প্রোয়েগল যোগ্যতা অর্জন।
2. বাংলা সাহিত্য গঠন-পাঠনের মাধ্যমে জাতীয় চেতনা, দেশ জগতে, মুক্তিযুদ্ধের চেতনা, ভাষাচার, নীতি ও মূল্যবোধের উন্নয়ন ঘটানো।

সর্বকন্ঠে বিবরণী:
মাতৃভাষা ও সৃজনশীলতা: বাংলা ভাষা রীতির বিচিত্রতা, বাণিজ্য রীতি, পত্র রচনা এবং কবিতা, প্রবন্ধ, নাটক, উপন্যাস ও ছোট গল্প।

বিশদ বিবরণে:
1. বাংলা ভাষার প্রয়োগ:
   ক) বাংলা ভাষা:
   ভাষার সংস্করণ, বাংলা ভাষা রীতি - সাধু, চরিত, আঞ্চলিক বা উপভাষা (সংস্করণ, বৈশিষ্ট্য, গার্ড ও উনাহরণ)
   খ) বাংলা বাণিজ্য রীতি ও শব্দ প্রয়োগ:
   1. বাংলা এককের প্রথম বাণিজ্য রীতি, ৪-সু ও ৪-সু বিবিধ
   2. শব্দ ও শব্দের প্রাপ্তিবিবর্ণ (সংস্করণ, শব্দের গঠন, উৎস বা উৎপত্তি ও অর্থগত )
   ৩. বান্দা গ্রন্থাগ্রন্থ ও গঠন রীতি (সংস্করণ, বাক্য গঠন এবং প্রকাশ)
   ে) পত্র রচনা:
   আবেদন পত্র (চাকরিক, ছোট), চাকরিতে যোগাযোগ পত্র, মানসম্পত্তি, শ্রদ্ধালুভাব, সংবাদপত্রে প্রকাশের জন্য পত্র

2. বাংলা সাহিত্য:
   ে) কবিতা:
   ১. বঙ্গভাষা - মহিকেল মধুসূদন দত্ত
   ২. সোনার তরী - রবীন্দ্র নাথ ঠাকুর
   ৩. উমেশ দাস - কাজী নজরুল ইসলাম
   ৪. বাংলার মুখ আমি - জীবননন্দ দাশ
   ৫. আসাদের শাখা - শামসুর রাহমান
   ৬. আধুনিক শব্দটি কি করে আমাদের হলো? - নির্মলন্দু ওপর
   খ) প্রবন্ধ:
   ১. অর্থধর্মী - ভোকেয়া সাকাওয়াত হোসেন
   ২. রেইকনা - নৈসায় মুজতরা আলী
   গ) একাধিকা (লাটিকা):
   ১. মানুষ - মুনিত জুন্দুরী
   ঘ) উপন্যাস:
   ১. লালসালু - সৈয়দ ওয়ালী উল্লাহ
   ৩) ছোট গল্প:
   ১. হেমজী - রবীন্দ্র নাথ ঠাকুর
   ২. একুশের গল্প - জহির রায়হান
   ৩. পাতালভাসপাতল - হাসান আজিজুল হক

ব্যবহারিক

১. নির্ধারিত বক্তৃতা:
বাংলাদেশ ও বাংলা সংস্কৃতি, বিভিন্ন জাতীয় দিবস (একুশে ফেব্রুয়ারি ও আত্মজ্ঞাতিক
মাতৃভাষা দিবস, স্থানীয় দিবস, বিজয় দিবস, জাতীয় শোক দিবস, মুক্তিবর্ষ দিবস, মহান মে দিবস)
প্রাতিষ্ঠানিক বক্তৃতা: নবরত্ন শিবক/শাহাদাতীদের বরণ, গুরুত্ত্বপূর্ণ ব্যক্তিগত্রের আলমন উপলক্ষে বক্তৃতা।

২. উপস্থিত বক্তৃতা:
বিষয়বস্তু উন্মুক্ত

৩. আবৃত্তি:
১. মানব - কাজী নজরুল্লাহ ইসলাম
২. আকাশ নীলা - জীবননন্দ দাশ
৩. পলরী জননী - জেলীম উদ্দীন
৪. ছাড়পত্র - বুকাঙ্গ ভট্টাচার্য
৫. তোমাকে পাওয়ার জন্য হে স্থানীয় - শামসুর রাহমান
৬. নির্দিষ্ট সম্পাদকীয় - হেলাল হাফিজ

৪. বিতর্ক (নমুনা)
সংস্কৃতিভিত্তিক আধুনিক মানুষের ধর্ম
তথ্য: প্রযুক্তির অবদান ব্যবহারের যুগ সমাজের অববাহকতার মূল কারণ
গতানুগতিক শিবা নয়, কষ্টমুখী শিবাই অধ্যাতন মুক্তির চাকুচাকু
চালকের অসাফলতাতে সর্বপ্রথম প্রধান কারণ
মুক্তিযুদ্ধের চেতনাই অসামান্য বাংলাদেশ প্রতিষ্ঠান মূলমন্ত্র
প্রযুক্তির বিকাশে প্রকৃতি বিনাশের একমাত্র কারণ

৫. প্রতিবেদন, প্রণয়ন ও উপস্থাপন:
স্বায়ত্ত বিভিন্ন সমস্যা ও অনুসন্ধান যে কোন বিষয়।
Full Marks: 100

Continuous Assessment : 40 Marks

Theory (Final Exam) : 60 Marks

Objectives:

After the completion of the course, learners will be able to develop-
- Reading, Listening with understanding
- The fluency of speech
- Grammatical accuracy with emphasis on spelling & punctuation
- Creative writing

CONTENT

Seen comprehension :( Marks-20)

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N.B: The Unit mentioned refers to the Text Book (1st Paper) English for Today for class 11 – 12
Grammar (Marks-20)

1. **(a) Uses of Articles.**
   (b) Uses of Tense *(Right forms of verbs with indicators)*
   (c) Classify verbs: *(Regular and Irregular verbs, Auxiliary, Principal, finite, non-finite verbs,)*
2. **Sentence:**
   (a) Changing Sentences: *(Assertive, Interrogative, Optative, Imperative, Exclamatory Simple, Complex and Compound), Comparison Of Adjectives/Adverbs*
   (b) Question making: WH, Yes/No, Tag question
3. Enrich vocabulary: synonyms, Antonyms ; suffix and prefix.
4. Voice , Narration
5. **Sentence Analysis :**
   Study of part of Speech *(Type of verbs- Regular and Irregular verbs, Auxiliary and Principal verb)*
   Study Of Phrases and Clauses *( Noun/ Adjective/ verb/ participle /adverbial/ prepositional phrases and Principal /Sub ordinate //co ordinate clauses )*

Free Writing (Marks -20)

1. Write dialogues: *(with teacher, principal, shopkeeper, hotel manager, station master, newcomer, buyers, doctor, friend, colleagues etc.)*
2. Report writing on different events/ occasions/ accidents.
3. Writing situational personal and official letters.
4. Writing job application with CV /Appointment letter / joining letter
5. Write a guided paragraph with questions.
**AIMS**
To provide the students with an opportunity to acquire knowledge and skills to

- Perform different metal & fitting works.
- Perform basic welding works.
- Use and take care of fitting and welding tools & equipment.

**SHORT DESCRIPTION**
Fitting: Safety Precautions, Common hand tools; Measuring instruments; Laying out; Sawing, chipping, filing, grinding and finishing, drilling and thread cutting;
Welding: Arc welding; Gas welding; welding with non-ferrous metal; Resistance welding; TIG & MIG welding; Gas & Plasma cutting.

**Practical:**
1. Understand the safely productions in Fitting & welding shop:
   1.1. State general safety precaution in Fitting shop.
   1.2. State general safety precaution in welding shop.
   1.3. State the importance of good house keeping.
2. Demonstrate the application of basic metal working hand tools.
   2.1. Identify common hand tools used for metal and fitting works.
   2.2. Check hand tools for sharpness.
   2.3. Carry out minor maintenance and sharpening of tools used for fitting works.
   2.4. Follow safety procedure during working in the fitting shop.
3. Demonstrate the application of measuring instruments and gages for bench work.
   3.1. Identify the measuring and layout tools.
   3.2. Take measurement with vernier caliper and micrometer.
   3.3. Measure and layout a fitting job.
   3.4. Check/measure with gages (sheet and wire gage, drill gage, etc).
4. Show skill in sawing, chipping, filing, drilling, reaming and grinding.
   4.1. Identify the operations of sawing, chipping, filing, drilling, reaming and.
   4.2. Perform sawing, chipping, filing, drilling, reaming and grinding operations.
   4.3. Make a job involving sawing, chipping, filing, drilling, reaming and grinding operations (Hinge, Angle gage, etc).
   4.4. Follow safety procedures during sawing, chipping, filing, drilling, reaming and grinding.
5. Show skill in cutting threads.
   5.1. Identify the taps and dies.
   5.2. Cut internal and external threads with tap and die.
   5.3. Follow safety procedures during working with taps and dies.
   6.1. Select appropriate sheet metal.
   6.2. Select tools and equipment for sheet metal works.
   6.3. Layout the sheet for jobs (Development Drawing).
   6.4. Make seam joint.
   6.5. Rectangular tray, Dust pan, Funnel etc.
7. Show skill in Arc Welding:
   7.1. Identify the Arc welding machine.
   7.2. Select tools and equipment for Arc welding.
   7.3. Prepare a workpiece for an Arc welding joint.
   7.4. Select Proper current and voltage for Arc welding.
7.5 Select appropriate electrode.
7.6 Practice uniform and straight weld bead.
7.7 Make Arc welding joints 1F, 2F (Lap, butt, tee, corner, etc.)
7.8 Follow safe working procedures during Arc welding.

8 **Show skill in Gas Welding:**
8.1 Identify the Gas welding cylinders.
8.2 Select tools and equipment for Gas welding.
8.3 Prepare a workpiece for a Gas welding joint.
8.4 Select appropriate a filler rod and flux.
8.5 Select appropriate flame for Gas welding.
8.6 Practice uniform and straight weld bead.
8.7 Make Gas welding joints 1F, 2F (Lap, butt, tee, corner, etc.)
8.8 Follow safe working procedures during Gas welding.

9 **Show skill in Gas and Plasma cutting**
9.1 Identify the Gas cutting torch and Plasma cutting machine.
9.2 Select tools and equipment for Gas cutting and Plasma cutting machine.
9.3 Select appropriate flame and high pressure oxygen flow for gas cutting.
9.4 Select appropriate current, voltage and high presser air flow for plasma cutting.
9.5 Metal cutting by gas and plasma cutting machine.
9.6 Follow safe working procedures during Gas and plasma cutting machine.

10 **Show Skill in TIG Welding:**
10.1 Identify the TIG welding machine.
10.2 Select tools and equipment for TIG welding.
10.3 Prepare a workpiece for a TIG joint.
10.4 Select Proper current and voltage for TIG welding.
10.5 Select appropriate electrode and holder / electrode casing.
10.6 Practice uniform and straight weld bead.
10.7 Make TIG welding joints 1F (butt.)
10.8 Follow safe working procedures during TIG welding.

11 **Show Skill in MIG Welding:**
11.1 Identify the MIG welding machine.
11.2 Select tools and equipment for MIG welding.
11.3 Prepare a workpiece for a MIG joint.
11.4 Select Proper current and voltage for MIG welding.
11.5 Select appropriate electrode and pressure roller.
11.6 Practice uniform and straight weld bead
11.7 Make MIG welding joints 1F (butt.)
11.8 Follow safe working procedures during MIG welding.

12 **Show skill in resistance welding.**
12.1 Identify the resistance welding machines.
12.2 Identify accessories and tools for resistance welding.
12.3 Make spot welding joints.
12.4 Follow safe working procedures during working with spot welding machine.

**REFERENCE BOOKS**
1 Basic Sheet Metal Practice — J. W. Giachino
2 Prathomic Fitting Sikkha — Hemanta Kumar Bhattacharia
3 Welding Principles for Engineers — Morris
4 Metal Fabrication — Robert L. O’con
5 Sheet Metal Work — Blackburn & Cassidy
6 Manufacturing Technology Lab Manual — T Jeyapoovan • S Sundaram
OBJECTIVES

• To acquaint the students with the basic terminology of Algebra.
• To be able to understand the complex numbers which are being used in electrical engineering.
• To be able to understand the binomial expansion.
• To be able to use the knowledge of trigonometry in solving problems of engineering importance.

SHORT DESCRIPTION

Algebra : AP & GP, Polynomials & polynomial equations, Complex number, Permutation & Combination, Binomial theorem for positive integral index and negative & fractional index.

Trigonometry: Ratio of associated angles, Compound angles, Transformation formulae, multiple angles and Sub-multiple angles.

DETAIL DESCRIPTION

ALGEBRA :

1 Understand the concept of AP & GP.
   1.1 Define AP and common difference.
   1.2 Find last term and sum of n terms, given first term and common difference.
   1.3 Define GP and common ratio.
   1.4 Find the sum of n terms given first and common ratio.

2 Apply the concept of polynomial in solving the problems.
   2.1 Define polynomials and polynomial equation.
   2.2 Explain the roots and co-efficient of polynomial equations.
   2.3 Find the relation between roots and co-efficient of the polynomial equations.
   2.4 Determine the roots and their nature of quadratic polynomial equations.
   2.5 Form the equation when the roots of the quadratic polynomial equations are given.
   2.6 Find the condition of the common roots of quadratic polynomial equations.
   2.7 Solve the problems related to the above.

3 Understand the concept of complex numbers.
   3.1 Define complex numbers.
   3.2 Perform algebraic operation (addition, subtraction, multiplication, division, square root) with complex number of the form a + ib.
   3.3 Find the cube roots of unity.
   3.4 Apply the properties of cube root of unity in solving problems.

4 Apply the concept of permutation.
   4.1 Explain permutation.
   4.2 Find the number of permutation of n things taken r at a time when,
      i) things are all different.
      ii) things are not all different.
   4.3 Solve problems of the related to permutation :
      i) be arranged so that the vowels may never be separated. From 10 man and 6 women a committee of 7 is to be formed. In how many ways can this be done so as to include at least two women in the committee.

5 Apply the concept of Combination.
   5.1 Explain combination.
   5.2 Find the number of combination of n different things taken r at a time.
   5.3 Explain \( \binom{n}{r} \), \( \binom{n}{n} \), \( \binom{n}{0} \)
   5.4 Find the number of combination of n things taken r at a time in which p particular things
      i) Always occur   ii) never occur.
   5.5 Establish i) \( \binom{n}{r} = \binom{n}{n-r} \)
\[ nCr + nC_{r-1} = (n+1)C_r \]

5.6 Solve problems related to combination.

6 Apply partial fraction to break the numerator and denominator.

6.1 Define proper and improper fractions.

6.2 Resolve into partial fraction of the followings types:
   a) Denominator having a non-repeated linear factor.
   b) Denominator having a repeated linear factor.
   c) Denominator having a quadratic factor.
   d) Denominator having a combination of repeated, non-repeated and quadratic factors.

7 Apply the concept of binomial theorem.

7.1 State binomial expression.

7.2 Express the binomial theorem for positive index.

7.3 Find the general term, middle term, equidistant term and term independent of x.

7.4 Use binomial theorem to find the value of
   i) \((0.9998)^2\), correct to six places of decimal.
   ii) \((1 + \sqrt{2})^5 - (1 - \sqrt{2})^5\)

8 Apply the concept of binomial theorem for negative index.

8.1 Express the binomial theorem for negative and fractional index.

8.2 Solve problems of the following types:
   \[ \left( 1 - nx \right)^{-\frac{1}{n}} \quad \text{ii) } \frac{1}{\sqrt{4.08}} \]

TRIGONOMETRY:

9 Apply the concept of associated angles.

9.1 Define associated angles.

9.2 Find the sign of trigonometrical function in different quadrants.

9.3 Calculate trigonometrical ratios of associated angle.

9.4 Solve the problems using above.

10 Apply the principle of trigonometrical ratios of compound angles.

10.1 Define compound angles.

10.2 Establish the following relation geometrically for acute angles.
   i) \(\sin (A \pm B) = \sin A \cos B \pm \cos A \sin B\).
   ii) \(\cos (A \pm B) = \cos A \cos B \pm \sin A \sin B\).

10.3 Deduce formula for \(\tan (A \pm B)\), \(\cot (A \pm B)\).

10.4 Apply the identities to work out the problems:
   i) \(\text{find the value of } \sin 75^\circ, \tan 75^\circ\).
   ii) \(\text{show that } \frac{\sin 75^\circ + \sin 15^\circ}{\sin 75^\circ - \sin 15^\circ} = \sqrt{3}\)
   iii) \(\text{if } \alpha + \beta = \theta, \tan \alpha + \tan \beta = b, \cot \alpha + \cot \beta = a, \)
      \(\text{show that } (a - b) = ab \cot \theta \).

11 Apply sum and product formula of trigonometrical ratios.

11.1 Express sum or difference of two sines and cosines as a product and vice-versa

11.2 Solve problems of the followings types:
   i) \(\text{show that, } \sin 55^\circ + \cos 55^\circ = \sqrt{2} \cos 10^\circ\)
   ii) \(\text{prove that, } \cos 80^\circ \cos 60^\circ \cos 40^\circ \cos 20^\circ = \frac{1}{16}\)

12 Apply the concept of ratios of multiple angles.

12.1 State the identities for \(\sin 2A, \cos 2A \text{ and } \tan 2A\).

12.2 Deduce formula for \(\sin 3A, \cos 3A \text{ and } \tan 3A\).

12.3 Solve the problems of the followings types.
   i) \(\text{express } \cos 5\theta \text{ in terms of } \cos \theta\).
   ii) \(\text{if } \tan \alpha = 2 \tan \beta, \text{show that, } \tan \left(\alpha + \beta\right) = \frac{3 \sin 2\alpha}{1 + 3 \cos 2\alpha}\)

13 Apply the concept of ratios of sub-multiple angles.
13.1 Find mathematically the identities for \( \sin \alpha \), \( \cos \alpha \) and \( \tan \alpha \) in terms of \( \frac{\alpha}{2} \) and \( \frac{\alpha}{3} \).

13.2 Solve the problems of the type:
find the value of \(\cos 3^\circ, \cos 6^\circ, \cos 9^\circ, \cos 18^\circ, \cos 36^\circ\) etc.

### Reference

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<tr>
<th>SL No</th>
<th>Author</th>
<th>Title</th>
<th>Publication</th>
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<tr>
<td>01</td>
<td>S. P Deshpande</td>
<td>Mathematics for Polytechnic Students</td>
<td>Pune Vidyarthi Graha Prakashan</td>
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<tr>
<td>02</td>
<td>H. K. Das</td>
<td>Mathematics for Polytechnic Students (Volume I)</td>
<td>S. Chand Prakashan</td>
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<tr>
<td>03</td>
<td>Ashim Kumar Saha</td>
<td>Higher Mathematics</td>
<td>Akshar patra Prakashani</td>
</tr>
<tr>
<td>04</td>
<td>S.U Ahamed &amp; M A Jabbar</td>
<td>Higher Mathematics</td>
<td>Alpha Prakashani</td>
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Objectives:
1. To understand mole concept and volumetric analysis.
2. To represent the formation of bonds in molecules.
3. Able to select appropriate materials used in construction.
4. Apply knowledge to enhance operative life span of engineering material and structure by various protective methods.

Short Description: Chemistry is a basic science subject which is essential to all engineering courses. It gives knowledge of engineering material, their properties related application and selection of material for engineering application. It is intended to teach student the quality of water and its treatment as per the requirement and selection of various construction materials and their protection by metallic and organic coatings. The topics covered will provide sufficient fundamental as well as background knowledge for the particular branch.

Section - 01 (physical and Inorganic Chemistry)

1. Atomic Structure and Chemical Bond
   1.1 Definition of Element, atoms, molecules, Fundamental particle of atom, their mass, charge, location.
   1.2 Definition of atomic number, mass number, Isotope, Isotone and Isobar.
   1.3 Electronic configuration based on Hunds Rule, Aufbau’s principle, Paulis exclusion principle.
   1.4 Definition of atomic weight, equivalent weight of an element, molecular weight, mole in terms of number, mass, volume.
   1.5 Define symbol, valency and formula.
   1.6 Explain Chemical bond, octet rule.
   1.7 Explain Formation of various types of chemical bonds: Covalent, Ionic, Co-ordinate bond.
   1.8 Explain the bonding along with example \( \text{CH}_4, \text{H}_2\text{O}_2, \text{NaCl}, \text{MgCl}_2 \).
   1.9 Explain Quantum number, Orbit and Orbital.

2. Ionic Equilibrium
   2.1 Concept of acid, base, salt and types of salts.
   2.2 \( \text{pH}, \text{pOH}, \text{pH} \) scale.
   2.3 Basicity of an acid and acidity of a base.
   2.4 Normality, molarity, molality, Volumetric analysis.
   2.5 Titration and Indicator.
   2.6 Buffer solution and its mechanism.

3. Chemical reaction, oxidation and reduction.
   3.1 Define Chemical reaction and explain the various type of chemical reaction.
   3.2 Explain the full meaning of a chemical equation.
   3.3 Concept of catalyst.
   3.4 Modern concept of oxidation and reduction.
   3.5 Simultaneous Process of Oxidation and Reduction.
   3.6 Explain the oxidation number.
4. Water Treatment

4.1 Concept of hard and soft water
4.2 Hardness of water
4.3 Describe the softening method of permuted process and ion exchange resin process.
4.4 Advantage and Disadvantage of hard water in different industries.
4.5 Water treatment plant visit and reporting.

5. Corrosion and Alloy

5.1 Types of corrosion (dry and wet corrosion)
5.2 Atmospheric corrosion, Types of atmospheric corrosion and their mechanism, oxide films factors affecting atmospheric corrosion.
5.3 Electrochemical corrosion, Mechanism of electrochemical corrosion. Types of electrochemical corrosion. Factors affecting electrochemical corrosion.
5.4 Protective measures against corrosion: Coating (Galvanic and Zinc, Organic coating coating agents, Electroplating, metal cladding)
5.5 Concept of alloy.

Section -2 (Organic Chemistry)

6. Organic Chemistry and Introduction to polymers:

6.1 Types of Chemistry.
6.2 Catenation property of carbon.
6.3 Organic compounds, its properties and applications.
6.4 Classification of organic compound by structure and functional group: Define: Homologous series, Alkanes, Alkenes and alkynes; Properties and uses of general formula; Names and Structure of first five members hydrocarbons.
6.5 Polymer, monomer, classification of polymers, Polymerization, addition and condensation polymerization.
6.6 Plastics: definition, its types and uses.

Section -3 (Industrial Chemistry)

7. Glass and Ceramic:

7.1 Concept of Glass and its constituents, Classification and uses of different glass, elementary idea of manufacturing process of glass.
7.2 Introduction to ceramic materials, Its constituent.
7.3 Industrial application of glass and ceramic.
7.4 Industry visit and reporting.
8. Soap and Detergent:

8.1 Introduction – A. Lipid  B. Fats and oils
8.2 Saponification of fats and oils, Manufacturing of soap.
8.3 Synthetic detergent, types of detergents and its manufacturing.
8.4 Exclusives: TNT, RDX, Dynamite.
8.5 Paint and Varnish
8.6 Adhesives.

9. Cement, pulp and papers:

9.1 Concept of cement and its constituents, Classification and uses of different cement,
manufacturing process of cement.
9.2 Manufacturing process of pulp and papers.
9.3 Industry visit and reporting.

Section - 4 (Practical Chemistry)

1. Use of laboratory tools and safety measures

2. Observation and measurement :

2.1 Determine the strength of HCl solution using 0.1N Na₂CO₃
2.2 Determine the strength of NaOH by using 0.1N HCl solution.

3. Qualitative analysis of known and unknown salts :

3.1 Identification of known salt (sample Copper, Iron, Aluminum, led, Ammonium and Zinc salt.)
3.2 Identification of unknown basic radical (e.g. led, Copper, Iron, Zinc, Aluminum, Ammonium)
3.3 Identification of unknown acid radicals (e.g. Chloride, Nitrate, Sulphate, Carbonate)

Source or Reference Book
1. Higher secondary Chemistry (paper 1st and 2nd)
   Writer Dr.Gazi Md.Ahsanul Karim. And Md.Robiul Islam
2. Higher secondary Chemistry (Paper 1st and 2nd)
   Writer Dr.Soroz kanti Singha Hazari .
3. An Introduction to Metallic corrosion and its prevention
   Writer Raj Narayan.
4. Organic Chemistry
   Writer Morrisson and Boyad.
5. Inorganic Chemistry