# BANGLADESH TECHNICAL EDUCATION BOARD

**Agargaon, Sher-E-Bangla Nagar**

**Dhaka-1207.**

**04-YEAR DIPLOMA IN ENGINEERING CURRICULUM**

**COURSE STRUCTURE & SYLLABUS**

**(PROBIDHAN-2022)**

# CHEMICAL TECHNOLOGY

**TECHNOLOGY CODE: 63**

**4TH SEMESTER**

(Effective from 2022-2023 Academic Sessions)

# DIPLOMA IN ENGINEERING CURRICULUM

## COURSE STRUCTURE

### (PROBIDHAN-2022)

### TECHNOLOGY NAME: CHEMICAL TECHNOLOGY (63)

### (4TH SEMESTER)

| Sl. No. | Subject | | Period Per Week | | Credit | Marks Distribution | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | Theory Assessment | | | Practical Assessment | | | Grand Total |
| | Code | Name | Theory | Practical | | Continuous | Final | Total | Continuous | Final | Total | |
| 1 | 25831 | Business Communication | 2 | - | 2 | 40 | 60 | 100 | - | - | - | 100 |
| 2 | 25841 | Accounting | 2 | - | 2 | 40 | 60 | 100 | - | - | - | 100 |
| 3 | 26341 | Chemical Engineering Operation-II | 2 | 3 | 3 | 40 | 60 | 100 | 25 | 25 | 50 | 150 |
| 4 | 26342 | Chemical Process Industries-I | 2 | 3 | 3 | 40 | 60 | 100 | 25 | 25 | 50 | 150 |
| 5 | 26343 | Oil, Fats & Waxes | 2 | 3 | 3 | 40 | 60 | 100 | 25 | 25 | 50 | 150 |
| 6 | 26344 | Analytical Chemistry | 2 | 3 | 3 | 40 | 60 | 100 | 25 | 25 | 50 | 150 |
| 7 | 28511 | Computer Office Application | - | 6 | 2 | - | - | - | 50 | 50 | 100 | 100 |
| 8 | 27041 | Engineering Mechanics | 2 | 3 | 3 | 40 | 60 | 100 | 25 | 25 | 50 | 150 |
| **Total** | | | **14** | **21** | **21** | **280** | **420** | **700** | **175** | **175** | **350** | **1,050** |
| **Total Period** | | | | **35** | | | | | | | | |
| **Theory: Practical (Ratio)** | | | **40.0%** | **60.0%** | | | | | | | | |

| Subject Code | Subject Name | Period per Week | | Credit |
|---|---|---|---|---|
| 25841 | Business Communication | T | P | C |
| | | 2 | 0 | 2 |

| | |
|---|---|
| **Rationale** | Business communication plays a vital role in modern time. Business communication the process of sharing information between employees within and outside a company. Business communication is essential for success and growth of every organization. By studying this course students will be able to acquire knowledge on communication, Communication model and feedback, Types of communication, Formal and informal communication, Report writing, Methods of communication, effective listening, Essentials of communication, Office management and developed skills on delivered effective presentation, interpersonal communication, listening, report writing and business letter. |
| **Learning Outcome** | **After completion of this course, students will be able to**<br>• Effective business communication.<br>• Developing and delivering effective presentations.<br>• Effective interpersonal communications.<br>• Good time management.<br>• Effective problem solving.<br>• Acquiring Knowledge of Information and Communication Technology.<br>• Effective business report writing. |

# Detailed Syllabus (Theory)

| Unit | Topics with Contents | Class (1 Period) | Final Marks |
|---|---|---|---|
| 1. | **Business communication.**<br><br>1.1 Define business.<br>1.2 Define communication.<br>1.3 Define business communication.<br>1.4 Describe the scope of business communication.<br>1.5 Mention the Importance of communication in modern business.<br>1.6 State the objectives of business communication.<br>1.7 State the functions of business communication.<br>1.8 Discuss the principles of communication.<br>1.9 Mention the essential elements of communication process. | **4** | **8** |
| 2. | **Communication model and feedback.**<br><br>2.1 Define communication model.<br>2.2 State the Importance of communication model.<br>2.3 State the basic functions of Communication model.<br>2.4 Mention the Limitation of communication model.<br>2.5 Define feedback.<br>2.6 State the basic principles of effective feedback.<br>2.7 State the essential feedback to complete communication process. | **3** | **6** |
| 3. | **Types of communication.**<br><br>3.1 Define channel of communication.<br>3.2 Mention the channel of communication.<br>3.3 State the different types of communication.<br>3.4 Distinguish between upward and downward communication.<br>3.5 State the merits and demerits of upward communication.<br>3.6 State the merits and demerits of downward communication.<br>3.7 Define two-way communication.<br>3.8 Explain-`Two-way communication is more important now a day.<br>3.9 State the merits and demerits of two-way communication. | **5** | **9** |
| 4. | **Formal and informal communication.**<br><br>4.1 Define the formal and informal communication.<br>4.2 Describe the advantages and disadvantages of formal communication**.**<br>4.3 Describe the advantages and disadvantages of informal communication.<br>4.4 Difference between formal and informal communication. | **2** | **4** |

| | | | |
|---|---|---|---|
| 5. | **Methods of communication.**<br>5.1 Define communication methods.<br>5.2 Discuss the various methods of communication.<br>5.3 Discuss the merits and demerits of oral communication.<br>5.4 Discuss the merits and demerits of written communication.<br>5.5 Difference between oral and written communication. | **3** | **6** |
| 6. | **Effective listening**<br>6.1 Define listening.<br>6.2 State the different types of listening.<br>6.3 State the importance of listening.<br>6.4 Define effective listening.<br>6.5 Discuss the barriers to effective listening.<br>6.6 Discuss the way for overcoming barriers to effective listening. | **3** | **5** |
| 7. | **Essentials of communication**<br>7.1 Discuss the essential qualities of good communication.<br>7.2 Discuss the barriers of communication.<br>7.3 Discuss the way for overcoming barriers to good communication. | **2** | **4** |
| 8. | **Report writing**<br>8.1 Define report, business report and technical report.<br>8.2 State the essential features of a good report.<br>8.3 Mention the factors to be considered while drafting a report.<br>8.4 State the components of technical report.<br>8.5 Distinguish between a technical report and general report.<br>8.6 Prepare a technical report. | **4** | **7** |
| **9.** | **Office management.**<br>9.1 Define office and office work.<br>9.2 State the characteristics of office work.<br>9.3 Define filing and indexing.<br>9.4 Discuses the method of filing.<br>9.5 Discuses the method of indexing.<br>9.6 Distinguish between filing and indexing. | **3** | **5** |
| **10.** | **Business letter, official and semiofficial letters.**<br>10.1 Define then business letter, official and semiofficial letters.<br>10.2 State the Importance of business letter.<br>10.3 Prepare Curriculum vitae (CV), Appointment letter, joining letter, leave letter, Complain Letter and tender notice. | **3** | **6** |
| | **Total** | **32** | **60** |

**REFERENCE BOOK:**


1. Business Communication and Report Writing-Professor Murtaza Ali
2. Business Communication-মো: খালেকুজ্জামান ও মো: মোশারফ হোসেন চৌধুরী

| Subject code | Subject Name | Period per week | | Credit |
|---|---|---|---|---|
| | | T | P | C |
| 25841 | Accounting | 2 | 0 | 2 |

| | |
|---|---|
| **Rationale** | All diploma graduate will work in any insttution or organization or will be an employer this subject knowledgable skill and attitude will health the studies to make appropriate decision for their professional life. This subject will cover the topics like informationtechnology, Evaluation of an organization, journal entry system,cash book analysisand Income Tax. |
| **Learning Outcome (Theoretical)** | After undergoing the subject, student will be able to:<br>▪ Describe accounting concept<br>▪ Describe transaction analysis<br>▪ Describe accounting entry system.<br>▪ Explain the accounts of debit and credit<br>▪ Interpret the journal entry system.<br>▪ Evalute the balance of ledger.<br>▪ Describe the cash book analysis.<br>▪ Evaluate of trial balance<br>▪ Expain the financial statement<br>▪ Describe income tax assesment. |

# Detailed Syllabus (Theory)

| Unit | Topics with contents | Class (1 Period) | Final Marks |
|---|---|---|---|
| 1. | **CONCEPT OF ACCOUNTING**<br>1.1 Define accounting.<br>1.2 State the objectives of accounting.<br>1.3 State the advantages of accounting.<br>1.4 State the necessity and scope of accounting. | 2 | 3 |
| 2. | **TRANSACTION ANALYSIS**<br>2.1 Define transaction.<br>2.2 Define business transaction.<br>2.3Describe the Characteristics of Transaction.<br>2.4Discuss the different types of Transaction. | 2 | 3 |
| 3. | **ENTRY SYSTEM OF ACCOUNTING**<br>3.1 Define single and double entry system.<br>3.2 Discuss the principles of double entry system.<br>3.3 Justify whether double entry system is an improvement over the single-entry system.<br>3.4 Distinguish between single entry and double entry system of accounting | 1 | 3 |
| 4. | **CONCEPT OF ACCOUNTS**<br>4.1 Define accounts.<br>4.2 State the objectives of accounts.<br>4.3 Illustrate different type of accounts.<br>4.4 State the golden rules of accounting.<br>4.5 State the rules for debit and credit in each class of accounts.<br>4.6 Define accounting cycle. | 2 | 3 |
| 5. | **JOURNAL ENTRY SYSTEM**<br>5.1 Define journal.<br>5.2 State the objective of journal.<br>5.3 Mention the various names of journal.<br>5.4 Prepare the form of journal entry system.<br>5.5 Solve the problem related journal entry system. | 4 | 10 |
| 6. | **LEDGER**<br>6.1 Define ledger<br>6.2 Interpret the form of ledger<br>6.3 Distinguish between journal and ledger<br>6.4 Explain “ledger is called the king of all books of accounts”<br>6.5 Prepare ledger from given transaction | 2 | 3 |
| 7. | **CASH BOOK ANALYSIS**<br>7.1 Define cash book.<br>7.2 Classifycash book.<br>7.3 Explain cash book as both journal and ledger.<br>7.4 Explain the different types of discount.<br>7.5 Prepare different types of cash books from given transactions showing balances. | 4 | 10 |
| 8. | **TRIAL BALANCE ANALYSIS**<br>8.1 Define trial balance.<br>8.2 State the objective of a trial balance.<br>8.3 Mentiion the reasonnon-agreement of trial balance.<br>8.4 Prepare trial balance from given balance. | 3 | 3 |
| 9. | **FINAL ACCOUNTS** | 10 | 20 |

| | | | |
|---|---|---|---|
| | 9.1 State the components of final accounts<br>9.2 Distinguish between trial balance and balance sheet<br>9.4 List the items to be posted in the trading account profit and loss account and the balance sheet<br>9.5 Prepare trading account profit and loss account and balance sheet from the given trial balance and other information | | |
| **10.** | **INCOME TAX**<br>10.1 Define income tax.<br>10.2 State the objective of income tax.<br>10.3 Classify of assesses.<br>10.4 State the Taxable income of assesses.<br>10.5 Describe the Tax rebate.<br>10.6 Describe ther Income tax year, assessment year and National Board of Revenue (NBR). | **2** | **2** |
| | **Total** | **32** | **60** |

## REFERENCE BOOKS

| SL | Book Name | Writer Name |
|---|---|---|
| 1. | Book-Keeping & Accounting | Prof. Gazi Abdus Salam |
| 2. | Principles of Accounting | Hafiz uddin |
| 3. | Cost Accounting | Prof. Asimuddin Mondol |
| 4. | হিসাবরক্ষন ও হিসাববিজ্ঞান | পরেশ মন্ডল |
| 5. | উচ্চ মাধ্যমিক হিসাববিজ্ঞান | হক ও হোসাইন |
| 6. | আয়কর | ওয়ালীউল্লাহ |

| Subject Code | Subject Name | Period per Week | | Credit |
|---|---|---|---|---|
| 26341 | Chemical Engineering Operation-2 | T | P | C |
| | | 2 | 3 | 3 |

| | |
|---|---|
| **Rationale** | Bangladesh is a developing country. Industrialization is growing fast. Chemical process industries are very much essential for developing country. Due to this reason Chemical engineering is an emerging technology not only in Bangladesh but all over the world. Modern and sophisticate chemical processing industries depending on dynamic chemical engineers for sustainability, health & safety issue and also safe environmental issue. Skill and knowledge of chemical engineering are the pre-requisite to meet the demand of existing and upcoming chemical process industries. So, this subject is introduced in the curriculum for Diploma in Chemical Engineering Course. The subject will enable the diploma engineers to know the mode of heat transfer, equipment's of heat transfer like, heat exchangers, boilers. Boiler mountings, boiler accessories and boiler auxiliaries, Steam and its properties, thermal insulations and Turbines. |
| **Learning Outcome (Theoretical)** | **AFTER UNDERGOING THE SUBJECT, STUDENTS WILL BE ABLE TO:**<br>▪ Explain heat transfer.<br>▪ Distinguish mode of heat transfer.<br>▪ Interpret different types of heat transfer.<br>▪ Explain the heat transfer through plane wall, round shape wall and spherical wall.<br>▪ Solve problems on conduction, convection and radiation.<br>▪ Compare among double tube, multitube, finned tube and plate type heat exchanger.<br>▪ Sketch the fire tube and water tube boiler.<br>▪ Describe boiler mountings, boiler accessories and boiler auxiliaries<br>▪ Compare different types of steam.<br>▪ Mention the advantage of super-heated steam.<br>▪ Define thermal insulation.<br>▪ Mention application of thermal insulation.<br>▪ State Turbine and the uses of Tribune. |
| **Learning Outcome (Practical)** | **AFTER UNDERGOING THE SUBJECT, STUDENTS WILL BE ABLE TO:**<br>▪ Operate a shell and tube heat exchanger<br>▪ Demonstrate and operate a plate heat exchanger<br>▪ Demonstrate and operate a water tube boiler<br>▪ Demonstrate and operate a fire tube boiler<br>▪ Identify the auxiliaries and accessories of a water tube boiler<br>▪ Identify and draw the mountings of a fire tube boiler<br>▪ Identify the different parts of a turbine<br>▪ Determine the total amount of heat conduction through a thick wall |

# Detailed Syllabus (Theory)

| Unit | Topics with Contents | Class (1 Period) | Final Marks |
|---|---|---|---|
| 1 | **HEAT TRANSFER**<br>1.1 Define heat transfer.<br>1.2 Mention the basic considerations of heat transfer.<br>1.3 Explain "heat transfer co-efficient" and "overall heat transfer co-efficient".<br>1.4 Explain "log mean temperature difference (LMTD)".<br>1.5 Solve the problems on overall heat transfer co-efficient and log mean temperature difference. | **2** | **4** |
| 2 | **HEAT TRANSFER BY CONDUCTION**<br>2.1 Define conduction of heat transfer.<br>2.2 State Fourier's law.<br>2.3 State thermal conductivity<br>2.4 Mention the units of thermal conductivity.<br>2.5 Explain the conduction of heat through a plane wall.<br>2.6 Explain the thermal resistances in series.<br>2.7 Explain the conduction through a thick-walled tube.<br>2.8 Explain the conduction through a sphere.<br>2.9 Solve the problems on heat transfer by conduction. | **4** | **8** |
| 3 | **HEAT TRANSFER BY CONVECTION AND RADIATION**<br>3.1 Define convection and radiation of heat transfer.<br>3.2 State film coefficient for convection.<br>3.3 Explain different types of convection.<br>3.4 Deduce the equation for overall heat transfer coefficient.<br>3.5 Define absorptivity, reflectivity and transmissivity of heat through a body.<br>3.6 State black body, white body and gray body.<br>3.7 Explain the Kirchoff's law of heat transfer by radiation.<br>3.8 Explain the energy emission by a black body.<br>3.9 Solve problems on heat transfer by convection and radiation. | **3** | **8** |
| 4 | **FEATURES OF HEAT EXCHANGERS**<br>4.1 Define heat exchanger.<br>4.2 List the different types of heat exchangers.<br>4.3 Explain shell and tube heat exchanger, finned tube heat exchanger and plate heat exchanger.<br>4.4 Draw and explain the temperature profile of parallel current and counter current heat exchangers.<br>4.5 Explain log mean temperature difference (LMTD) for parallel-current and counter current heat exchangers.<br>4.6 Solve problems on heat exchangers. | **4** | **8** |

| | | | |
|---|---|---|---|
| 5 | **FEATURES OF BOILERS**<br>5.1 Define boiler.<br>5.2 Classify boilers.<br>5.3 Distinguish between internally and externally fire tube boiler.<br>5.4 Mention the advantages and disadvantages of fire tube boiler and water tube boiler.<br>5.5 Explain the construction and operation of common types of boilers.<br>5.6 Mention the precautions for boiler operation system.<br>5.7 State the general maintenance of boilers. | **4** | **8** |
| 6 | **FEATURES OF BOILER MOUNTINGS**<br>6.1 State boiler mountings.<br>6.2 List the name of main boiler mountings.<br>6.3 Mention the functions of water level indicator, plain gauge glass, pressure gauge and safety valve of a boiler.<br>6.4 Explain the working principles of common safety valves.<br>6.5 Describe the construction and working principle of feed/check valve, blow down cock and fusible plug. | **4** | **6** |
| 7 | **FEATURES OF BOILER ACCESSORIES AND AUXILIARIES**<br>7.1 State boiler accessories.<br>7.2 List different types of boiler accessories.<br>7.3 Explain feed water regulator, economizer, feed water strainer, steam purifier, steam trap and super heater.<br>7.4 Mention the functions of various boiler accessories.<br>7.5 State boiler auxiliaries.<br>7.6 List different types of boiler auxiliaries.<br>7.7 Explain feed water pump, water injector, feet water heater (economizer), air pre heater and condenser.<br>7.8 Mention the functions of various boiler auxiliaries.<br>7.9 Mention the specification of boiler feed water. | **3** | **6** |
| 8 | **STEAM**<br>8.1 Define steam.<br>8.2 Mention the aspects of steam<br>8.3 State dry steam, wet steam, saturated steam and superheated steam.<br>8.4 Mention the properties of saturated and superheated steam.<br>8.5 List the uses and advantages of superheated steam.<br>8.6 Mention the uses of steam table. | **2** | **4** |
| 9 | **THERMAL INSULATION**<br>9.1 Define thermal insulation.<br>9.2 List the materials of thermal insulation.<br>9.3 Mention the characteristics of thermal insulating materials.<br>9.4 Mention the application of thermal insulation.<br>9.5 State the economic thickness of lagging by thermal insulating materials. | **2** | **3** |

| | | | |
|---|---|---|---|
| 10 | **TURBINES**<br>10.1 Define turbine.<br>10.2 List the different types of turbines.<br>10.3 Describe the construction and working principle of impulse turbine.<br>10.4 Describe the construction and working principle of reaction turbine.<br>10.5 Differentiate between impulse and reaction turbines.<br>10.6 Define water turbine governor.<br>10.7 Mention the function, types and uses of governor.<br>10.8 Describe the construction and working principle of servo-motor or relay system of hydraulic governor. | **4** | **5** |
| | **Total** | **32** | **60** |

# Detailed Syllabus (Practical)

| Sl. | Experiment name with procedure | Class (3 Period) | Total Marks |
|---|---|---|---|
| 1 | **OPERATE A SHELL AND TUBE HEAT EXCHANGER**<br>1.1 Follow Occupational Safety and Health (OSH)<br>1.2 Select, Collect and Ware Personal Protective Equipment (PPE)<br>1.3 Select and Collect Required Tools and Equipment<br>1.4 Read Operation Manual / Instruction sheet / Job sheet<br>1.5 Operate Shell and Tube head exchanger as per Instructor<br>1.6 Maintain the record of exchange temperature<br>1.7 Clean and Store tools and Equipment as required<br>1.8 Submit report of performed job to the teacher | 2 | 6 |
| 2 | **DEMONSTRATE AND OPERATE A PLATE HEAT EXCHANGER**<br>2.1 Follow OSH<br>2.2 Select, Collect and Ware Personal Protective Equipment (PPE)<br>2.3 Select and Collect Required Tools and Equipment<br>2.4 Read Operation Manual / Instruction sheet / Job sheet<br>2.5 Operate Plate head exchanger as per Instructor<br>2.6 Maintain the record of exchange temperature<br>2.7 Clean and Store tools and Equipment as required<br>2.8 Submit report of performed job to the teacher | 2 | 6 |
| 3 | **DEMONSTRATE AND OPERATE A WATER TUBE BOILER**<br>3.1 Follow OSH<br>3.2 Select, Collect and Ware Personal Protective Equipment (PPE)<br>3.3 Select and Collect Required Tools and Equipment<br>3.4 Read Operation Manual / Instruction sheet / Job sheet<br>3.5 Demonstrate and operate a water tube boiler.<br>3.6 Maintain the record of steam pressure & temperature, water level & flow and fuel consumption<br>3.7 Clean and Store tools and Equipment as required<br>3.8 Submit report of performed job to the teacher | 2 | 6 |

| | | | |
|---|---|---|---|
| 4 | **DEMONSTRATE AND OPERATE A FIRE TUBE BOILER**<br>4.1 Follow OSH<br>4.2 Select, Collect and Ware Personal Protective Equipment (PPE)<br>4.3 Select and Collect Required Tools and Equipment<br>4.4 Read Operation Manual / Instruction sheet / Job sheet<br>4.5 Demonstrate and operate a fire tube boiler.<br>4.6 Maintain the record of steam pressure & temperature, water level & flow and fuel consumption<br>4.7 Clean and Store tools and Equipment as required<br>4.8 Submit report of performed job to the teacher | 2 | 6 |
| 5 | **IDENTIFY THE AUXILIARIES AND ACCESSORIES OF A WATER TUBE BOILER**<br>5.1 Follow Occupational Safety and Health (OSH)<br>5.2 Select, Collect and Ware Personal Protective Equipment (PPE)<br>5.3 Select and Collect Required Tools and Equipment<br>5.4 Read Operation Manual / Instruction sheet / Job sheet<br>5.5 Identify and list boiler Auxiliaries and accessories<br>5.6 Mention the functions of boiler Auxiliaries and accessories<br>5.7 Clean and Store tools and Equipment as required<br>5.8 Submit report of performed job to the teacher | 2 | 7 |
| 6 | **IDENTIFY AND DRAW THE MOUNTINGS OF A FIRE TUBE BOILER**<br>6.1 Select, Collect and Ware Personal Protective Equipment (PPE)<br>6.2 Select and Collect Required Tools and Equipment<br>6.3 Read Operation Manual / Instruction sheet / Job sheet<br>6.4 Draw the diagram of safety valve, level indicator, pressure gauge and feed check valve.<br>6.5 Mention the functions of safety valve, level indicator, pressure gauge and feed check valve.<br>6.6 Clean and Store tools and Equipment as required<br>6.7 Submit report of performed job to the teacher | 2 | 7 |
| 7 | **IDENTIFY THE DIFFERENT PARTS OF A TURBINE**<br>7.1 Follow OSH<br>7.2 Select, Collect and Ware Personal Protective Equipment (PPE)<br>7.3 Select and Collect Required Tools and Equipment<br>7.4 Read Operation Manual / Instruction sheet / Job sheet<br>7.5 Select a turbine and disassemble all the parts of turbine as per instructions<br>7.6 Mark major component/part of turbine<br>7.7 Label the component/part of turbine<br>7.8 Reassemble all the parts as per instructions<br>7.9 Maintain the record of performed job<br>7.10 Submit the performed job to the Teacher | 2 | 6 |
| 8 | **DETERMINE THE TOTAL AMOUNT OF HEAT CONDUCTION THROUGH A THICK WALL**<br>8.1 Follow OSH<br>8.2 Select, Collect and Ware Personal Protective Equipment (PPE)<br>8.3 Select and Collect Required Tools and Equipment | 2 | 6 |

| | | | |
|---|---|---|---|
| | 8.4 Read Instruction sheet / Job sheet<br>8.5 Perform the job according to instruction sheet<br>8.6 Record and submit the job report to the Teacher. | | |
| | Total | 16 | 50 |

## Necessary Resources (Tools, equipment's and Machinery):

| Sl | Item Name | Quantity |
|---|---|---|
| 01 | Adjustable wrench, spanner, screw driver, Hammer | 1set |
| 02 | Thermometer, Metallic pot, Scale, Slide Calipers | 1 set |
| 03 | Heat Exchanger (Multitube and Plate type) | 1 set |
| 04 | Boiler (Fire tube and Water tube) | 1 set |
| 05 | Turbine | 1 set |
| 06 | Required PPE | 1 set |

## Recommended Books:

| Sl | Book Name | Writer Name | Publisher Name & Edition |
|---|---|---|---|
| 01 | Chemical Engineering operation-2 | - A.K.Md.Wahidul Haque | BTEB |
| 02 | Introduction to Chemical Engineering | Badger and Banchero | |
| 03 | Chemical Engineering, I & II (3rd edition | J. M. Coulsom and J. F. Richardson | |
| 04 | Chemical Engineering Hand Book | - Perry | |
| 05 | An Introduction Chemical Engineering | - C. E. Littejohn and G. F. Meenaghan | |
| 06 | Shreve's Chemical Process Industrials | - George T. Austin | |
| 07 | Hydraulics and Hydraulic Machinery | Kazi Saleh Ahmed | BTEB |

## Website References:

| Sl | Web Link | Remarks |
|---|---|---|
| **01** | https://www.goodreads.com/book/show/2207547.Introduction_To_Chemical_Engineering | |
| **02** | https://www.amazon.com/Coulson-RichardsonS-Chemical-Engineering-3rd/dp/8131204529 | |
| **03** | https://chembugs.files.wordpress.com/2015/12/perrys-chemical-engineering-handbook1.pdf | |

| Subject Code | Subject Name | Period per Week | | Credit |
|---|---|---|---|---|
| 26342 | CHEMICAL PROCESS INDUSTRIES-1 | T | P | C |
| | | 2 | 3 | 3 |

| | |
|---|---|
| **Rationale** | Bangladesh is a developing country. Industrialization is growing fast. Chemical process industries are very much essential for developing country. Due to this reason Chemical engineering is an emerging technology not only in Bangladesh but all over the world. Modern and sophisticate chemical processing industries depending on dynamic chemical engineers for sustainability, health & safety issue and also safe environmental issue. Skill and knowledge of chemical engineering are the pre-requisite to meet the demand of existing and upcoming chemical process industries. So, this subject is introduced in the curriculum for Diploma in Chemical Engineering Course. The subject will enable the diploma engineers to know the manufacturing process of salt, hydrochloric acid, nitric acid, abrasive, bleaching powder, pigment, paint, varnish, enamel and lacquer, glue and gelatin and also the basic idea of textile processing, dyeing, printing and finishing. |
| **Learning Outcome (Theoretical)** | **AFTER UNDERGOING THE SUBJECT, STUDENTS WILL BE ABLE TO:**<br>▪ Explain salt.<br>▪ Illustrate hydrochloric acid and nitric acid.<br>▪ Interpret abrasive.<br>▪ Prepare bleaching powder.<br>▪ Produce pigment, paint, varnish, enamel and lacquer.<br>▪ Interpret idea of textile processing, dyeing, printing and finishing.<br>▪ Produce glue and gelatin |
| **Learning Outcome (Practical)** | **AFTER UNDERGOING THE SUBJECT, STUDENTS WILL BE ABLE TO:**<br>▪ Determine % of Sodium chloride in brine<br>▪ Determine the strength of Hydrochloric acid solution<br>▪ Determine the strength of Nitric acid solution<br>▪ Draw the process flow chart for manufacturing of silicon carbide.<br>▪ Determine available chlorine in bleaching powder<br>▪ Draw the process flow chart for manufacturing of ultramarine<br>▪ Prepare paint and varnish<br>▪ Draw the process flow chart for manufacturing of enamel<br>▪ Draw the process flow chart for manufacturing of Glue and Gelatin |

# Detailed Syllabus (Theory)

| Unit | Topics with Contents | Class (1 Period) | Final Marks |
|---|---|---|---|
| 1 | **SALT**<br>1.1 Define common salt.<br>1.2 Mention the sources of salt materials.<br>1.3 list the different grades of salt.<br>1.4 Describe the methods of manufacture of salt.<br>1.5 Explain the process of manufacture of salt by Vacuum Evaporation Method.<br>1.6 Mention the uses of salt.<br>1.7 List the by-products of salt | **2** | **4** |
| 2 | **HYDROCHLORIC ACID**<br>2.1 Define Hydrochloric acid.<br>2.2 List the raw materials for Hydrochloric acid.<br>2.3 Draw the process flow chart for the manufacture of Hydrochloric acid.<br>2.4 Describe the manufacturing process of hydrochloric acid by synthetic process.<br>2.5 Describe the manufacturing process of hydrochloric acid by Lablanc salt cake process.<br>2.6 Mention the handling precaution of hydrochloric acid<br>2.7 Mention the uses of hydrochloric acid | **3** | **5** |
| 3 | **NITRIC ACID**<br>3.1 Define Nitric acid.<br>3.2 List the raw materials for Nitric acid.<br>3.3 Draw the process flow chart for the manufacture of nitric acid.<br>3.4 Describe the method of manufacture of nitric acid.<br>3.5 Define aqua resin.<br>3.6 Mention of handling of nitric acid.<br>3.7 Mention the uses of nitric acid. | **3** | **5** |
| 4 | **CONCEPT OF ABRASIVE**<br>4.1 Define abrasive.<br>4.2 Explain properties of abrasive.<br>4.3 Mention importance abrasive name.<br>4.4 Explain manufacturing process of silicon carbide, fused alumina and boron carbide.<br>4.5 Describe preparation method of grinding wheel.<br>4.6 Explain the uses of silicon carbide, fused alumina and boron carbide | **3** | **5** |

| | | | |
|---|---|---|---|
| 5 | **BLEACHING POWDER**<br>5.1 Define bleaching powder.<br>5.2 List the raw materials for bleaching powder.<br>5.3 Mention the chemical formula of bleaching powder.<br>5.4 Mention the manufacturing process of bleaching powder.<br>5.5 Describe the Hasenclever process for the manufacture of bleaching powder.<br>5.6 Describe the Backmann process for the manufacture of bleaching powder<br>5.7 Write the chemical properties of bleaching powder.<br>5.8 Mention the application of bleaching powder. | **4** | **6** |
| 6 | **PIGMENT**<br>6.1 Explain the meaning of pigments.<br>6.2 List of pigments.<br>6.3 Explain manufacturing process of white pigment.<br>6.4 Describe manufacturing methods of ultramarine.<br>6.5 Explain manufacturing process of carbon black<br>6.6 Explain manufacturing process of lithophone.<br>6.7 Describe manufacturing process of red lead.<br>6.8 Describe manufacturing process of chrome green. | **4** | **6** |
| 7 | **PAINT**<br>7.1 Define paint.<br>7.2 Mention the classification of paint.<br>7.3 State the properties of a good paint.<br>7.4 List the constituents of paint.<br>7.5 Explain the functions of the paint constituents.<br>7.6 State the setting of paint.<br>7.7 Describe manufacturing process of paint with flow chart. | **3** | **6** |
| 8 | **VARNISH, ENAMEL AND LACQUERS**<br>8.1 State the meaning of varnish, enamel and lacquers.<br>8.2 List the raw materials used for the manufacturing of varnishes.<br>8.3 Explain manufacturing process of varnishes.<br>8.4 Mention the uses of varnishes<br>8.5 Describe the manufacturing process of enamels<br>8.6 Mention the uses of varnishes<br>8.7 List the constituents of lacquers.<br>8.8 Describe the manufacturing process of lacquer.<br>8.9 Mention the uses of lacquer. | **3** | **6** |
| 9 | **BASIC IDEA OF TEXTILE PROCESSING.**<br>9.1 Define wet process.<br>9.2 Classify wet process system.<br>9.3 Draw a process flow-chart of wet process for manufacturing of yarn.<br>9.4 State singeing and de-sizing.<br>9.5 Mention the purposes of singeing. | **2** | **6** |

| | | | |
|---|---|---|---|
| | 9.6 Define scouring.<br>9.7 Mention the purpose of scouring. | | |
| 10 | **DYEING & PRINTING.**<br>10.1 Define color, dye and dyeing.<br>10.2 Mention the purpose of dyeing.<br>10.3 List the commercially important dyes with their commercial names.<br>10.4 Describe the general idea of dying.<br>10.5 Define the printing<br>10.6 Mention the purposes of printing.<br>10.7 List the methods of printing.<br>10.8 Describe general idea of printing.<br>10.9 Explain general idea of Textile finishing. | **3** | **6** |
| 11 | **CONCEPT OF GLUE AND GELATIN**<br>11.1 Define glue and gelatin<br>11.2 Explain the manufacturing process of glue.<br>11.3 Describe the manufacturing process of gelatin.<br>11.4 Mention the uses of glue and gelatin. | **2** | **5** |
| | **Total** | **32** | **60** |

# Detailed Syllabus (Practical)

| Sl. | Experiment name with procedure | Class (3 Period) | Total Marks |
|---|---|---|---|
| 1 | **DETERMINE % OF SODIUM CHOLORIDE IN BRINE**<br>1.1 Follow Occupational Safety and Health (OSH)<br>1.2 Select, collect and wear Personal Protective Equipment (PPE)<br>1.3 Select and collect required tools and equipment<br>1.4 Follow laboratory sheet / Instruction sheet / Job sheet<br>1.5 Calculate results/Take result.<br>1.6 Maintain the record of the performed task.<br>1.7 Clean and store tools and equipment as required | 2 | 3 |
| 2 | **DETERMINE STRENGTH OF HYDROCHLORIC ACID**<br>2.1 Follow OSH<br>2.2 Select, collect and wear PPE<br>2.3 Select and collect different types of chemical and apparatus.<br>2.4 Follow laboratory sheet / Instruction sheet / Job sheet<br>2.5 Calculate results/Take result.<br>2.6 Maintain the record of the performed task.<br>2.7 Clean and store tools and equipment as required | 3 | 3 |
| 3 | **DETERMINE STRENGTH OF NITRIC ACID**<br>3.1 Follow OSH<br>3.2 Select, collect and wear PPE<br>3.3 Select and collect required tools and equipment<br>3.4 Select and collect different types of chemical and apparatus | 3 | 3 |

| | | | |
|---|---|---|---|
| | 3.5 Follow laboratory sheet / Instruction sheet / Job sheet<br>3.6 Calculate results/Take result.<br>3.7 Maintain the record of the performed task<br>3.8 Clean and store tools and equipment as required | | |
| 4 | **DRAW THE PROCESS FLOW CHART FOR MANUFACTURING OF SILICON CARBIDE.**<br>4.1 Follow OSH<br>4.2 Select, and collect flow chart of silicon carbide<br>4.3 Collect required drawing instrument and other's (pencil, scale, eraser, cutter, drawing sheet, etc.<br>4.4 Draw the process flow chart for the manufacturing of silicon carbide.<br>4.5 Maintain the record of the performed task | 1 | 3 |
| 5 | **DETERMINE AVAILABLE CHLORINE IN BLEACHING POWDER**<br>5.1 Follow OSH<br>5.2 Select, Collect and Wear Personal Protective Equipment (PPE)<br>5.3 Select and collect different types of chemical and apparatus.<br>5.4 Follow laboratory sheet / Instruction sheet / Job sheet<br>5.5 Calculate results/Take result.<br>5.6 Maintain the record of the performed task.<br>5.7 Clean and store tools and equipment as required | 2 | 3 |
| 6 | **DRAW THE PROCESS FLOW CHART FOR MANUFACTURING OF ULTRAMARINE.**<br>6.1 Select, Collect and wear PPE<br>6.2 Select and collect flow chart of ultramarine<br>6.3 Collect required drawing instrument and other's (pencil, scale, eraser, cutter, drawing sheet, etc.<br>6.4 Draw the process flow chart for the manufacturing of ultramarine.<br>6.5 Maintain the record of the performed task. | 1 | 2 |
| 7 | **PREPARE PAINT AND VARNISH**<br>7.1 Follow OSH<br>7.2 Select, collect and wear PPE<br>7.3 Select and collect different types of chemical Tools and Equipment.<br>7.4 Follow laboratory sheet / Instruction sheet / Job sheet.<br>7.5 Perform the job according to instruction sheet.<br>7.6 Maintain the record of performed job. | 2 | 3 |
| 8 | **DRAW THE PROCESS FLOW CHART FOR MANUFACTURING OF ENAMEL.**<br>8.1 Follow OSH<br>8.2 Select, collect flow chart of enamel<br>8.3 Collect required drawing instrument and other's (pencil, scale, eraser, cutter, drawing sheet, etc.<br>8.4 Draw the process flow chart of enamel<br>8.5 Maintain the record of the perform job. | 1 | 2 |
| 9 | **DRAW THE PROCESS FLOW CHART FOR MANUFACTURING OF GLUE AND GELATIN** | 1 | 3 |

| | | | |
|---|---|---|---|
| | 9.1 Follow OSH<br>9.2 Select and collect flow chart of glue and gelatin<br>9.3 Collect required drawing instrument and pencil, scale, eraser, cutter, drawing sheet.<br>9.4 Draw the process flow chart of glue and gelatin.<br>9.5 Maintain the record of the perform job. | | |
| | **Total** | **16** | **25** |

## NECESSARY RESOURCES (TOOLS, EQUIPMENT'S AND MACHINERY):

| Sl | Item Name | Quantity |
|---|---|---|
| 1. | Hand gloves (one time hand glove, Heat resistance hand glove, washable hand glove) | 1 Box |
| 2. | Safety goggles | 10 Pcs |
| 3. | Ear plug | 10 Pair |
| 4. | Mask | 1 Box |
| 5. | Lab apron | 10 Pcs |
| 6. | Safety shoe | 10 Pair |
| 7. | Hair net | 1 Box |
| 8. | Beaker (50, 100, 250, 500, 1000 ml) | 5 Nos |
| 9. | Burette (10, 25, 50 ml) | 5 Nos |
| 10. | Brush (wire) | 5 Nos |
| 11. | Bunsen Burner | 5 Nos |
| 12. | Balance (Digital) | 2 Nos |
| 13. | Balance (analytical) | 2 Nos |
| 14. | Capillary Tube | 5 Nos |
| 15. | Chemical Storage Cabinet with tray | 2 Nos |
| 16. | Funnel | 5 Nos |
| 17. | Flask (Conical) | 5 Nos |
| 18. | Flask (Erlenmeyer) | 5 Nos |
| 19. | Flask (volumetric) (50, 100, 250, 500, 1000 ml) | 5 Nos |
| 20. | Fume hood | 2Nos |
| 21. | Glass Fiber or Filter paper | 1 Box |
| 22. | Hot Plate | 5 Nos |
| 23. | Hot plate with Magnetic Stirrer | 1Nos |
| 24. | Laboratory Thermometer ($^0$C, $^0$F) | 5 Nos |
| 25. | Measuring Cylinder (50, 100, 250, 500, 1000 ml) | 5 Nos |
| 26. | pH meter (Digital/Hand) | 5 Nos |
| 27. | Pipette (Graduated) (1, 2, 5, 10, 20, 25, 50 ml) | 5 Nos |
| 28. | Pipette (volumetric) (1, 2, 5, 10, 20, 50, 100 ml) | 5 Nos |
| 29. | Spatulas | 5 Nos |
| 30. | Test tube | 5 Nos |
| 31. | Test tube holder | 5Nos |
| 32. | Tripod stand | 5 Nos |

| | | |
|---|---|---|
| 33. | Wash Bottle | 5 Nos |
| 34. | Water Bath | 2 Nos |
| 35. | Wire mesh | 5 Nos |

## Recommended Books:

| Sl | Book Name | Writer Name | Publisher Name & Edition |
|---|---|---|---|
| 01 | Shreve's Chemical Process Industrials | - George T. Austin | |
| 02 | Dryden's Outlines of Chemical Technology | M.Gopala Rao and Marshall Sitting | |
| 03 | Industrial Chemistry (Vol-I & II) | R.K. Das | |
| 04 | Modern Applied Chemistry | -A.N. Zamre, V.G. Ratolikar | |
| 05 | Industrial Chemistry | -B.K. Sharma | |
| 06 | Industrial Chemistry | Sayed Ahsan Habib Muhammad Shabuddin Mridha | Shams Chemistry Publication Dhaka,Bangladesh |

## Website References:

| Sl | Web Link | Remarks |
|---|---|---|
| 01 | https://www.rokomari.com/book/105160/shreve-s-chemical-process-industries | |
| 02 | https://www.amazon.com/Drydens-Outlines-Chemical-Technology-Century/dp/8185938792 | |
| 03 | https://chembugs.files.wordpress.com/2015/12/perrys-chemical-engineering-handbook1.pdf | |
| 04 | https://www.academia.edu/9511336/Riegels_Handbook_of_Industrial_Chemistry | |
| 05 | https://www.mayaspublication.com/images/book-detail/mpchemistry1/ICBook-front.pdf | |

| SUBJECT CODE | SUBJECT NAME | PERIOD PER WEEK | | CREDIT |
|---|---|---|---|---|
| | | T | P | C |
| 26343 | OIL,FATS AND WAXES | 2 | 3 | 3 |

| | |
|---|---|
| **Rationale** | Day by day industrialization is growing fast. Chemical and food process industries are very much essential for a developing country. Due to this reason Chemical engineering is an emerging technology not only in Bangladesh but also all over the world. Modern and sophisticate chemical processing industries depending on dynamic chemical engineer for sustainability, health and safety issue and also safe environment issue. Skill and knowledge of chemical engineering are the pre-requisite to meet the demand of existing and upcoming chemical process industries. So that oil, fats and waxes subject is introduced in the curriculum for diploma in chemical engineering course. The subject is uses chemical and food processes to transform raw materials into products that are beneficial to mankind.<br><br>This includes oil, fats and waxes understanding, classification, refining, splitting, saponification, acid value, iodine value, melting point, extraction, hydrogenation, related flow sheet and etc. |
| **Learning Outcome (Theoretical)** | **After undergoing the subject, students will be able to**<br>• Define oils, fats and waxes.<br>• Illustrate production methods of oils, fats and waxes.<br>• State uses and importance of oils, fats and waxes.<br>• Describe economic importance of oils, fats and waxes.<br>• Analyze the product of oils, fats and waxes.<br>• Draw the flow chart for production of oils, fats and waxes.<br>• Explain refining process of oil, fats.<br>• Discuss hydrogenation process. |
| **Learning Outcome (Practical)** | **After undergoing the subject, students will be able to**<br>1. Determine saponification value of oils and fats.<br>2. Determine acid value of oils and fats.<br>3. Determine the iodine value of oils and fats.<br>4. Test melting point of fats (Dalda).<br>5. Determine of free fatty acid(FFA).<br>6. Determine oil separation by solvent extractor (coconut, soybean, mustard seed).<br>7. Draw flow chart of hydrogenation process of soybean oil.<br>8. Draw flow chart for processing of soybean/cotton seed oil.<br>9. Determine rancidity value of oil/fats. |

# DETAILED SYLLABUS (THEORY)

| Unit | Topics with Contents | Class (1 Period) | Final Marks |
|---|---|---|---|
| 1. | **OIL FATS AND WAXES**<br>1.1 Discuss historical background of oil, fats and waxes.<br>1.2 Mention the sources of oils, fats and waxes.<br>1.3 Classify oils, fats and waxes.<br>1.4 Distinguish between oil and fats.<br>1.5 State structural formula of oils and fats.<br>1.6 State physical and chemical properties of oil and fats.<br>1.7 Describe industrial uses of oil and fats.<br>1.8 Describe the economics importance of oil, fats in Bangladesh. | **03** | **06** |
| 2 | **FISH, ESSENTIAL AND MINERAL OILS**<br>2.1 Define fish oil.<br>2.2 List the different type of oils.<br>2.3 State essential oil and mineral oils.<br>2.4 Define edible oil and inedible oils.<br>2.5 Distinguish between edible and non-edible oils.<br>2.6 Mention the chemical composition of oil.<br>2.7 Describe the properties of lipid.<br>2.8 Define FFA, Iodine Value and Saponification Value. | **03** | **06** |
| 3 | **VEGETABLE OILS**<br>3.1 Define vegetable oil.<br>3.2 List the important of vegetable oils.<br>3.3 Explain oil extraction from cotton seed with flow chart.<br>3.4 Describe the production of soybean oil from soybean seed by solvent extraction process.<br>3.5 Describe the extraction of vegetable oils in expression process or hydraulic process.<br>3.6 Describe the production of coconut oil, palm oil and linseed oil with flow sheet.<br>3.7 Explain the production process of rice bran oil<br>3.8 Describe manufacturing process of sunflower oils. | **04** | **08** |
| 4 | **PROCESSING OF OILS (EDIBLE OIL)**<br>4.1 Explain processing of oil.<br>4.2 Define drying and non-drying oil.<br>4.3 State saturated and unsaturated oil.<br>4.4 Explain bleaching of oil.<br>4.5 Describe hydrogenation of oil.<br>4.6 State deodorizing of oils.<br>4.7 Explain the process flow diagram of hydrogenation of vegetable oil.<br>4.8 Describe the manufacturing process of mustard oil. | **03** | **07** |

| | | | |
|---|---|---|---|
| 5 | **REFINING OF EDIBLE OILS**<br>5.1 Define crude oil.<br>5.2 Mention the different crude oil.<br>5.3 Explain refining of Soybean and vegetables oil.<br>5.4 Write the meaning of CDSO.<br>5.5 Describe neutralization process of Edible oil.<br>5.6 Describe bleaching and deodorization process of Edible oil.<br>5.7 Draw the flow chart for the refining of vegetable oil.<br>5.8 Draw the flow chart for continuous refining process of Soybean and cotton seeds. | **04** | **08** |
| 6 | **ANIMAL OILS**<br>6.1 Define animal oil.<br>6.2 List important animal oils.<br>6.3 Describe the production of cod liver oil with flow chart.<br>6.4 Describe the production of lard with flow chart.<br>6.5 Mention the uses of animal oil. | **03** | **06** |
| 7 | **FAT AND FAT SPLITTING**<br>7.1 Define fat.<br>7.2 Mention the classification of fat.<br>7.3 Define fat splitting.<br>7.4 State fatty acid.<br>7.5 Mention the uses of fat and fatty acids.<br>7.6 State saponification value, acid value and iodine value of fat.<br>7.7 Describe fat splitting process.<br>7.8 Describe the extraction of tallow oil. | **04** | **06** |
| 8 | **FATTY ACID ANALYSIS**<br>8.1 State iodine value of fatty acid.<br>8.2 State melting point of fatty acid.<br>8.3 List the source of fatty acid.<br>8.4 Mention the uses of fatty acid.<br>8.5 Define rancidity of fatty acid.<br>8.6 Describe the production of fatty acid by using fractionating column.<br>8.7 Explain physical and chemical test of fatty acid. | **05** | **07** |
| **9** | **WAXES**<br>9.1 Define waxes.<br>9.2 List different types of waxes.<br>9.3 List the source of waxes.<br>9.4 Mention the uses of waxes.<br>9.5 State bees wax, paraffin wax, synthetic wax, Chinese wax, wool wax and vegetable wax.<br>9.6 Describe the production process of bees wax and synthetic wax. | **03** | **06** |
| | **Total** | **32** | **60** |

# DETAILED SYLLABUS (PRACTICAL)

| Sl. | Experiment Name | Class (3 Period) | Marks (Continuous) |
|---|---|---|---|
| 1 | **Determine the saponification value of oils and fats.**<br>1.1 Follow occupational safety and health (OSH).<br>1.2 Wear personal protective equipment (like as hand gloves, safety glass, apron, face mask, safety shoe).<br>1.3 Select & collect necessary tools & equipment. (like as conical flask, burette, pipette).<br>1.4 Collect required sample and chemicals (like as oil/fats, Potassium hydroxide, alcohol, hydrochloric acid, phenolphthalein indicator).<br>1.5 Follow instruction sheet.<br>1.6 Fill the table and calculate the result.<br>1.7 Maintain the precautions for glass ware.<br>1.8 Clean and store tools and equipment as required.<br>1.9 Maintain the record of performed task. | **02** | **03** |
| 2 | **Determine the acid value of supplied sample of oils and fats.**<br>2.1 Follow occupational safety and health (OSH).<br>2.2 Wear personal protective equipment (like as hand gloves, safety glass, apron, face mask, safety shoe).<br>2.3 Select & collect necessary tools & equipment (like as conical flask, burette, pipette).<br>2.4 Collect required sample and chemicals (like as oil/fats, Potassium hydroxide, ethyl alcohol, n-hexane, phenolphthalein).<br>2.5 Follow instruction sheet.<br>2.6 Determine the required amounts of chemicals for titration and make titration.<br>2.7 Calculate the result.<br>2.8 Maintain the precautions for glass ware.<br>2.9 Clean and store tools and equipment as required.<br>2.10 Maintain the record of performed task. | **02** | **03** |
| 3 | **Determine the iodine value of supplied sample of oil and fat.**<br>3.1 Follow occupational safety and health (OSH).<br>3.2 Wear personal protective equipment (like as hand gloves, safety glass, apron, face mask, safety shoe).<br>3.3 Select & collect necessary tools & equipment (like as beaker, conical flask, burette, pipette).<br>3.4 Collect necessary sample and chemicals (like as oil/fats, Potassium dichromate, Concentrated hydrochloric acid, potassium iodide, starch solution, standard sodium thiosulphate.<br>3.5 Follow instruction sheet.<br>3.6 Calculate the result.<br>3.7 Maintain the precautions for glass ware.<br>3.8 Clean and store tools and equipment as required.<br>3.9 Maintain the record of performed task. | **03** | **03** |
| 4 | **Determine the melting point of fats (Dalda).**<br>4.1 Follow occupational safety and health (OSH). | **02** | **03** |

| | | | |
|---|---|---|---|
| | 4.2 Wear personal protective equipment (like as hand gloves, safety glass, apron, face mask, safety shoe).<br>4.3 Select & collect necessary tools & equipment (like as oil and fats, Ice, capillary tubes, mercury thermometer, beaker, heating plate).<br>4.4 Freezing the sample.<br>4.5 Follow the instruction/worksheet<br>4.6 Calculate the result<br>4.7 Maintain the precautions for glass ware.<br>4.8 Clean and store tools and equipment as required.<br>4.9 Maintain the record of performed task. | | |
| 5 | **Determine free fatty acid.**<br>5.1 Follow occupational safety and health (OSH).<br>5.2 Wear personal protective equipment (like as hand gloves, safety glass, apron, face mask, safety shoe).<br>5.3 Select & collect necessary tools & equipment (like as beaker, flask).<br>5.4 Follow instruction sheet.<br>5.5 Calculate the result.<br>5.6 Maintain the precaution for glass ware.<br>5.7 Clean and store tools and equipment as required.<br>5.8 Maintain the record of performed task. | **01** | **03** |
| 6 | **Produce Oil by Solvent Extraction process**<br>Follow occupational safety and health (OSH).<br>6.1 Wear personal protective equipment (like as hand gloves, safety glass, apron, face mask, safety shoe).<br>6.2 Collect necessary equipment (like as Soxhlet apparatus).<br>6.3 Follow instruction sheet.<br>6.4 Maintain the precautions for glass ware.<br>6.5 Clean and store tools and equipment as required.<br>6.6 Maintain the record of performed task. | **02** | **03** |
| 7 | **Test Rancidity of fat/fatty acid.**<br>7.1 Follow occupational safety and health (OSH).<br>7.2 Wear personal protective equipment (like as hand gloves, safety glass, apron, face mask, safety shoe).<br>7.3 Select & collect necessary tools & equipment (like as conical flask, burette, pipette).<br>7.4 Collect necessary sample and chemicals (like as oil/fats, Potassium hydroxide, alcohol, hydrochloric acid, phenolphthalein).<br>7.5 Follow instruction sheet.<br>7.6 Maintain the precautions for glass ware.<br>7.7 Clean and store tools and equipment as required.<br>7.8 Maintain the record of performed task. | **02** | **03** |
| 8 | **Draw a flow chart for hydrogenation of oil.**<br>8.1 Collect flow chart of hydrogenation process.<br>8.2 Collect required drawing instrument and other's (pencil, scale, eraser, cutter, drawing sheet, etc).<br>8.3 Maintain the record of performed task. | **01** | **02** |

| | | | |
|---|---|---|---|
| 9 | **Draw a flow Chart for continuous process of edible oil.**<br>9.1 Collect flow chart of hydrogenation process.<br>9.2 Collect required drawing instrument and other's (pencil, scale, eraser, cutter, drawing sheet etc).<br>9.3 Maintain the record of performed task. | **01** | **02** |
| | Total | **16** | **25** |

## NECESSARY RESOURCES (TOOLS, EQUIPMENT'S AND MACHINERY):

| Sl | Item Name | Quantity |
|---|---|---|
| 01 | Soxhlet apparatus | 1 nos |
| 02 | Mercury thermometer | 1 nos |
| 03 | Capillary tube | 1 nos |

## RECOMMENDED BOOKS:

| Sl | Book Name | Writer Name | Publisher Name & Edition |
|---|---|---|---|
| 01 | Shreve's Chemical Process Industries | George T. Austin | Indian edition,5th edition |
| 02 | Dryden's Outlines of Chemical Technology | M. Gopala Rao and Marshall Sitting | East-west press,3rd edition |
| 03 | Industrial Chemistry (Vol & II) | R.K. Das | Asia publishing house,1967 |
| 04 | Applied Chemistry-1 | Dr.Raman Rani Mittal | S.K kataria and son,4th edition 2010. |
| 05 | Industrial Chemistry | B. K. Sharma | Goel publishing house 15th edition, 2006 |
| 06 | Fatty acids (chemistry, synthesis and application) | Moghis Ahmad | 1st Edition,2017 |

## WEBSITE REFERENCES:

| Sl | Web Link | Remarks |
|---|---|---|
| 01 | www.youtube.com | Search here with topics |
| 02 | www.google.com | Search here with topics |

| SUBJECT CODE | SUBJECT NAME | PERIOD PER WEEK | | CREDIT |
|---|---|---|---|---|
| 26344 | ANALYTICAL CHEMISTRY | T | P | C |
| | | 2 | 3 | 3 |

| | |
|---|---|
| **Rationale** | Bangladesh is a developing country. Industrialization is growing fast. Analytical Chemistry are very much essential for developing country. Due to this reason Chemical engineering is an emerging technology not only in Bangladesh but all over the world. Modern and sophisticate processing industries depending on dynamic chemical engineers for sustainability, health & safety issue and also safe environmental issue. Skill and knowledge of Analytical Chemistry are the pre-requisite to meet the demand of existing and upcoming process industries. So, this subject is introduced in the curriculum for Diploma in Chemical Engineering Course.<br><br>The subject will enable the diploma engineers to know the mode of Introduction to quantitative analysis; Modern Concepts of acid and bases; Volumetric analysis, Hydrogen ion concentration and pH; Buffer Solution & Indicators; Law of mass action; Ionic Equilibria; Complex standard solution; Chemical analysis of food; Gravimetric analysis; Hydrolysis of salts etc. |
| **Learning Outcome (Theoretical)** | **After undergoing the subject, students will be able to**<br>• State quantitative analysis and laboratory rules.<br>• Explain different types of accident.<br>• Describe various source of accidents in the laboratory.<br>• Describe the acids, bases and relative strengths in modern concept.<br>• State standard solution with standardization.<br>• Define pH, pH-Scale, Buffer solution and indicators.<br>• Describe the law of mass action.<br>• Relate between the equilibrium constants $K_p$ and $K_c$<br>• Describe preparation of complex standard solutions.<br>• Describe the method of determination POV (peroxide value) in Fats and oils.<br>• Describe the method of determination of Calcium, Phosphorous, Copper, Zinc and Iron in food.<br>• Differentiate between volumetric and gravimetric analysis.<br>• Explain hydrolysis of different types Salts. |
| **Learning Outcome (Practical)** | **After undergoing the subject, students will be able to**<br>1. Identify PPE, apparatus and laboratory appliance for analysis.<br>2. Prepare Standard solution of acid, base, salts and chemical reagents with standardization.<br>3. Operate the digital balance and hot plate.<br>4. Apply traceability with hazard sign for storing the prepared standard soln.<br>5. Calculate Free Fatty acid of Oils and Fats.<br>6. Operate kjeldahl apparatus and centrifuge.<br>7. Calculate vitamin A, B, C & D by volumetric method. |

# DETAILED SYLLABUS (THEORY)

| Unit | Topics with Contents | Class (1 Period) | Final Marks |
|---|---|---|---|
| 1 | **CONCEPT OF QUANTITATIVE ANALYSIS AND LABORATORY RULES**<br>1.1 Define analysis and quantitative analysis.<br>1.2 List different types of analysis.<br>1.3 Describe different types of quantitative analysis.<br>1.4 Describe Laboratory rules and safety for analysis.<br>1.5 List the poisonous, highly flammable and highly corrosive chemicals used in the analytical laboratory.<br>1.6 List the different laboratory accidents.<br>1.7 Mention the first aid for Minor cuts and injuries, Severe bleeding, burns by steam, hot water and fire, Burns by acids and alkalis, Poison inhaling from hydrogen sulphide, carbon mono-oxide, chlorine and bromine gases and fumes. | 02 | 03 |
| 2 | **MODERN CONCEPT OF ACID AND BASES**<br>2.1 Define acids and bases according to the Bronsted protonic Concept.<br>2.2 Define acids and bases, according to the Lewis Concept.<br>2.3 Define Conjugate acid and Conjugate base.<br>2.4 Explain the relative strength of acids and bases.<br>2.5 Explain the strength determination process of acids based on oxidation number.<br>2.6 Explain the order of increasing & decreasing acidity for HOCl, HOBr, HOI and HOF.<br>2.7 Explain the order of increasing & decreasing acidity for HCl, HBr, HI and HF.<br>2.8 Explain the order of increasing & decreasing acidity for HOC, HOCO, $HOCO_2$ and $HOCO_3$.<br>2.9 Explain the classification of following substances as acids and bases giving reasons.<br>$BF_3$, $NH_3$, $NH_4^+$, $Ag^+$, CaO, $SO_3$, KCN, $OH^-$, $H^+$, Na. | 04 | 07 |
| 3 | **CONCEPT OF VOLUMETRIC ANALYSIS**<br>3.1 Mention different apparatus used in quantitative analysis.<br>3.2 Explain Acidimetry, Alkalimetry, Normal solution and Normality, Equivalent weight of an acid, Bases and salt, Equivalent weight of oxidizing and reducing agent. Titration, End point and Neutralization.<br>3.3 Explain the preparation of standard 0.1N $Na_2CO_3$ solution.<br>3.4 Explain the preparation of 0.1N NaOH solution.<br>3.5 Explain the preparation of 0.1N $H_2SO_4$ solution.<br>3.6 Explain the standardization of 0.1N $H_2SO_4$ solution with standard NaOH solution.<br>3.7 Explain the preparation of 0.1N oxalic acid ($C_2H_2O_4$ .$2H_2O$) solution.<br>3.8 Explain the standardization of 0.1N NaOH solution with | 04 | 07 |

| | | | |
|---|---|---|---|
| | standard oxalic acid ($C_2H_2O_4$ .$2H_2O$) solution. | | |
| 4 | **CONCEPT OF HYDROGEN ION CONCENTRATION AND pH**<br>4.1 Explain hydrogen ion concentration.<br>4.2 Explain the pH of different types of solution.<br>4.3 Mention the mathematical expression of the pH.<br>4.4 Explain the pH scale.<br>4.5 Explain "pH of pure water is 7".<br>4.6 Solve the mathematical problems on pH. | 02 | 05 |
| 5 | **CONCEPT OF BUFFER SOLUTION**<br>5.1 Define buffer solution.<br>5.2 State the characteristics of buffer solution.<br>5.3 Explain buffer capacity.<br>5.4 Explain the mechanism of buffer solution.<br>5.5 List the pH range of ten buffer solution.<br>5.6 Define indicator.<br>5.7 Explain different types of indicators.<br>5.8 Explain the action of acid-base indicators.<br>5.9 Explain the pH range and color of ten acid-base indicators. | 02 | 06 |
| 6 | **CONCEPT OF LAW OF MASS ACTION**<br>6.1 Define reversible reaction.<br>6.2 Define chemical equilibrium.<br>6.3 List three Criteria of chemical equilibrium.<br>6.4 State the law of mass action.<br>6.5 Mention the mathematical expression of equilibrium constant.<br>6.6 Mention the relation between Kp, Kc and Kx mathematically.<br>6.7 Solve the problems of law of mass action. | 03 | 06 |
| 7 | **CONCEPT OF IONIC EQUILIBRIA**<br>7.1 Explain ionization constant.<br>7.2 Describe Ionic product of water.<br>7.3 State Ostwald's dilution law.<br>7.4 Express the deduction of the equation of Ostwald's dilution law<br>7.5 Mention the limitations of Ostwald's dilution law.<br>7.6 Explain the meaning of "Common ion effect".<br>7.7 Mention the application of common ion effect in the field of analytical chemistry.<br>7.8 Solve the problem on Ostwald's dilution law. | 03 | 05 |
| 8 | **PREPARATION OF COMPLEX STANDARD SOLUTIONS**<br>8.1 State the preparation process of 0.1N $KMnO_4$ solution.<br>8.2 Explain the standardization process of $KMnO_4$ solution.<br>8.3 Explain the preparation process of 0.1N $K_2Cr_2O_7$ solution.<br>8.4 Describe the preparation process of starch solution.<br>8.5 Explain the preparation process of 0.1N thiosulphate solution.<br>8.6 Discuss the standardization process of 0.1N thiosulphate solution. | 03 | 04 |
| 9 | **CONCEPT OF CHEMICAL ANALYSIS OF FOOD**<br>9.1 Describe the analytical components of food.<br>9.2 Mention the Importance to determine the nutrient present in | 04 | 08 |

| | | | |
|---|---|---|---|
| | food.<br>9.3 Describe the determination method of free fatty acid in fats and oils.<br>9.4 Describe the determination method of POV (per oxide value) in fats and oils.<br>9.5 Describe the volumetric method of fat determination in food.<br>9.6 State the determination method of protein in food by the kjeldahl method.<br>9.7 Describe the determination method of vitamin C in citrus fruits.<br>9.8 Describe the determination method of calcium, phosphorus, copper, zinc and iron in foods. | | |
| 10 | **CONCEPT OF GRAVIMETRIC ANALYSIS**<br>10.1 Define gravimetric analysis.<br>10.2 Explain the precipitation method of gravimetric separation of elements.<br>10.3 Explain the evolution method of gravimetric separation of elements.<br>10.4 Explain the electro-analytical method of gravimetric separation of elements.<br>10.5 Explain the mechanism of determination of iron as ferric oxide.<br>10.6 Mention the determination theory of nickel as dimethylglyoxime.<br>10.7 Describe the gravimetric method of fat determination.<br>10.8 Describe the separation method and estimation process of copper and zinc from cuprous thio cyanate and zinc ammonium phosphate respectively. | 03 | 05 |
| 11 | **HYDROLYSIS OF SALT**<br>11.1 Define hydrolysis.<br>11.2 State the hydrolysis of salt.<br>11.3 Explain the hydrolysis of salt of strong acid and strong base.<br>11.4 Explain the hydrolysis of salt of weak acid and weak base.<br>11.5 Describe the hydrolysis of salt of strong acid and weak base.<br>11.6 Explain the hydrolysis of salt of weak acid and strong base.<br>11.7 Mention the constant of hydrolysis.<br>11.8 Mention the degree of hydrolysis. | 02 | 04 |
| | **Total** | 32 | 60 |

# DETAILED SYLLABUS (PRACTICAL)

| Sl. | Experiment Name | Class (3 Period) | Marks (Continuous) |
|---|---|---|---|
| 1 | **Identify the apparatus and laboratory appliance for the purpose of quantitative analysis**<br>1.1 Follow the occupational health and safety.<br>1.2 Select and collect PPE and wear PPE.<br>1.3 Select and collect different types of chemical and | 1 | 2.5 |

| | | | |
|---|---|---|---|
| | apparatus.<br>1.4 Draw the different Apparatus, Laboratory appliances with names.<br>1.5 Maintain the record of the performed task. | | |
| 2 | **Prepare the 0.1 N NaOH, 1N HCl solutions and standardize**<br>2.1 Follow the occupational health and safety.<br>2.2 Select and collect PPE and wear PPE.<br>2.3 Follow the laboratory instruction sheet.<br>2.4 Select and collect NaOH, HCl, distilled water and apparatus.<br>2.5 Prepare the 0.1 N NaOH, 1N HCl solutions and standardize<br>2.6 Apply the traceability with hazard sign for storing the prepared standard chemicals.<br>2.7 Maintain the record of the performed task. | 2 | 2.5 |
| 3 | **Prepare the $CaCl_2$, $H_2SO_4$ solutions and standardize**<br>3.1 Follow the occupational health and safety.<br>3.2 Select and collect PPE and wear PPE.<br>3.3 Follow the laboratory instruction sheet.<br>3.4 Select and collect $CaCl_2$ (CaCO3,37%HCl), $H_2SO_4$ solution, distilled water and apparatus.<br>3.5 Prepare the $CaCl_2$, $H_2SO_4$ solutions and standardize<br>3.6 Apply the traceability with hazard sign for storing the prepared standard chemicals.<br>3.7 Maintain the record of the performed task. | 2 | 2.5 |
| 4 | **Prepare the 0.1N $Na_2S_2O_3$ solution and standardize**<br>4.1 Follow the occupational health and safety.<br>4.2 Select and collect PPE and wear PPE.<br>4.3 Follow the laboratory instruction sheet.<br>4.4 Select and collect $Na_2S_2O_3$, distilled water and apparatus.<br>4.5 Prepare the 0.1N $Na_2S_2O_3$ solution and standardize<br>4.6 Apply the traceability with hazard sign for storing the prepared standard chemicals.<br>4.7 Maintain the record of the performed task. | 1 | 2.5 |
| 5 | **Prepare the solvent- ethanol or isopropanol and Indicator- phenolphthalein or bromothymol blue**<br>5.1 Follow the occupational health and safety.<br>5.2 Select and collect PPE and wear PPE.<br>5.3 Follow the laboratory instruction sheet.<br>5.4 Select and collect Solvent (ethanol, Di-ethyl ether), phenolphthalein and distilled water and apparatus.<br>5.5 Prepare the solvent- ethanol or isopropanol and Indicator- phenolphthalein or bromothymol blue<br>5.6 Apply the traceability with hazard sign for storing the prepared standard chemicals.<br>5.7 Maintain the record of the performed task. | 1 | 2.5 |
| 6 | **Determine the POV (Peroxide Value) and Free Fatty acid of Oils and Fats**<br>6.1 Follow the occupational health and safety.<br>6.2 Select and collect PPE and wear PPE.<br>6.3 Follow the laboratory instruction sheet.<br>6.4 Select and collect different types of chemical and | 2 | 2.5 |

| | | | |
|---|---|---|---|
| | apparatus.<br>6.5 Analyze the POV (Peroxide Value) and Free Fatty acid of Oils and Fats<br>6.6 Calculate results.<br>6.7 Maintain the record of the performed task. | | |
| 7 | **Determine Calcium in food by volumetric method**<br>7.1 Follow the occupational health and safety.<br>7.2 Select and collect PPE and wear PPE.<br>7.3 Follow the laboratory instruction sheet.<br>7.4 Select and collect different types of chemical and apparatus.<br>7.5 Analyze Calcium in food by volumetric method<br>7.6 Calculate results.<br>7.7 Maintain the record of the performed task. | 1 | 2.5 |
| 8 | 8.1 Follow the occupational health and safety.<br>8.2 Select and collect PPE and wear PPE.<br>8.3 Follow the laboratory instruction sheet.<br>8.4 Select and collect different types of chemical and apparatus.<br>8.5 Analyze protein in food by kjeldahl method<br>8.6 Calculate results.<br>8.7 Maintain the record of the performed task. | 2 | 2.5 |
| 9 | **Determine Fat content in food by Soxhlet method**<br>9.1 Follow the occupational health and safety.<br>9.2 Select and collect PPE and wear PPE.<br>9.3 Follow the laboratory instruction sheet.<br>9.4 Select and collect different types of chemical and apparatus.<br>9.5 Analyze Fat content in food by Soxhlet method<br>9.6 Calculate results.<br>9.7 Maintain the record of the performed task. | 2 | 2.5 |
| 10 | **Determine vitamin A, B, C & D by the volumetric method**<br>10.1 Follow the occupational health and safety.<br>10.2 Select and collect PPE and wear PPE.<br>10.3 Follow the laboratory instruction sheet<br>10.4 Select and collect different types of chemical and apparatus.<br>10.5 Analyze vitamin A, B, C & D by the volumetric method<br>10.6 Calculate results.<br>10.7 Maintain the record of the performed task. | 2 | 2.5 |
| | **Total** | **16** | **25** |

## NECESSARY RESOURCES (TOOLS, EQUIPMENT'S AND MACHINERY):

| Sl | Item Name | Quantity |
|---|---|---|
| 1. | Hand gloves (one time hand glove, Heat resistance hand glove, washable hand glove) | 1 Box |
| 2. | Safety goggles | 10 Pcs |
| 3. | Ear plug | 10 Pair |
| 4. | Mask | 1 Box |

| | | |
|---|---|---|
| 5. | Lab apron | 10 Pcs |
| 6. | Safety shoe | 10 Pair |
| 7. | Hair net | 1 Box |
| 8. | Beaker (50, 100, 250, 500, 1000 ml) | 5 Nos |
| 9. | Burette (10, 25, 50 ml) | 5 Nos |
| 10. | Brush (wire) | 5 Nos |
| 11. | Bunsen Burner | 5 Nos |
| 12. | Balance (Digital) | 2 Nos |
| 13. | Balance (analytical) | 2 Nos |
| 14. | Capillary Tube | 5 Nos |
| 15. | Centrifuge | 2 Nos |
| 16. | Chemical Storage Cabinet with tray | 2 Nos |
| 17. | Funnel | 5 Nos |
| 18. | Flask (Conical) | 5 Nos |
| 19. | Flask (Erlenmeyer) | 5 Nos |
| 20. | Flask (Kjeldahl Flask) | 5 Nos |
| 21. | Flask (volumetric) (50, 100, 250, 500, 1000 ml) | 5 Nos |
| 22. | Fume hood | 2Nos |
| 23. | Glass Fiber or Filter paper | 1 Box |
| 24. | Hot Plate | 5 Nos |
| 25. | Hot plate with Magnetic Stirrer | 1Nos |
| 26. | Laboratory Thermometer ($^0$C, $^0$F) | 5 Nos |
| 27. | Measuring Cylinder (50, 100, 250, 500, 1000 ml) | 5 Nos |
| 28. | Mortar and pestle | 5 Nos |
| 29. | pH meter (Digital/Hand) | 5 Nos |
| 30. | Pipette (Graduated) (1, 2, 5, 10, 20, 25, 50 ml) | 5 Nos |
| 31. | Pipette (volumetric) (1, 2, 5, 10, 20, 50, 100 ml) | 5 Nos |
| 32. | Retort stand | 5 Nos |
| 33. | Separatory Funnel | 5 Nos |
| 34. | Soxhlet Extraction Apparatus | 2 Nos |
| 35. | Spatulas | 5 Nos |
| 36. | Test tube | 25 Nos |
| 37. | Test Tube holder | 5Nos |
| 38. | Tripod Stand | 5 Nos |
| 39. | Vortex Mixer | 2 Nos |
| 40. | Wash Bottle | 5 Nos |
| 41. | Water Bath | 2 Nos |
| 42. | Wire Mesh | 5 Nos |

**RECOMMENDED BOOKS:**

| Sl | Book Name | Writer Name | Publisher Name & Edition |
|---|---|---|---|
| 1. | Advanced Practical Chemistry, Vol-1,2,3 | B.S Ball and A.N Sharma | Pragati Prakashan, Educational Publishers |

| | | | |
|---|---|---|---|
| 2. | Advanced Experimental Chemistry | J.N Curtoo and R,Kapoor | |
| 3. | বৈশ্লেষনীয় ও ব্যবহারিক রসায়ন | ড. সরোজ কান্তি সিংহ হাজারী | কবির পাবলিকেশন |
| 4. | ব্যবহারিক অজৈব রসায়ন (স্নাতক) | নূরুল হক ও মহিরউদ্দিন | |

## WEBSITE REFERENCES:

| Sl | Web Link | Remarks |
|---|---|---|
| 1. | www.youtube.com | Search here with topics |
| 2. | www.google.com | Search here with topics |

| Subject Code | Subject Name | Period Per Week | | Credit |
|---|---|---|---|---|
| 28511 | COMPUTER OFFICE APPLICATION | T | P | C |
| | | 0 | 6 | 2 |

| | |
|---|---|
| **Rationale** | **This is a generic course for all diploma programs required to enable the graduates to use and work with ICT competently. It includes typing in Bangla and English, using the internet for e-communication & e-interaction, operating a computer and allied devices, Operating Word Processing, Spreadsheet Analysis, and Presentation software. This course also enables a graduate to adopt further study in upper-level courses using IT and other sectors. This course is designed to emphasize practical aspects rather than theory.** |
| **Course Learning Outcome** | **After undergoing the subject, students will be able to:**<br>• **type Bangla and English smoothly**<br>• **use internet for e-communication & interaction**<br>• **operate a computer and allied devices**<br>• **perform the operation of Word Processing App, Spreadsheet Application, and Presentation Package.** |

## Detailed Syllabus (Practical)

| CLO | Experiment name with the procedure | Class (3 Periods per class) | Marks |
|---|---|---|---|
| 1 | **TYPE TEXT AND DOCUMENTS IN ENGLISH AND BANGLA.**<br><br>**1.1 Startup and Shutdown of a computer.**<br>1.1.1 Identify Basic ***Computer Hardware*** devices<br>***Computer Hardware*****:** System Unit, Motherboard, Processor, Power supply, SSD, Hard Disk, RAM, ROM<br>1.1.2 Check Peripherals and connect with the system unit.<br>***Peripherals*****:** Monitor, Keyboard, Mouse, Modem, Scanner, Printer, Multimedia Projector<br>1.1.3 Connect Power cords/adapter properly with computer and power outlets socket.<br>1.1.4 Switch on the Computer gently.<br>1.1.5 Arrange and customize PC ***Desktop / GUI settings*** as per requirement.<br>***Desktop / GUI settings***: Icons, Taskbar, View, Resolutions<br>1.1.6 Close Unsaved files and folders<br>1.1.7 Close Open software and switch off hardware devices.<br>1.1.8 Switch off Computer gently.<br>1.1.9 Switched off Power at the respective power outlets.<br><br>**1.2 Install the Typing Tutor software.** | **3** | **5** |

| | | | |
|---|---|---|---|
| | 1.2.1. Identify Required *Hardware* and *software* of typing Tutor software.<br>***Software****:* Operating System, Microsoft Office, Open Office, Typing Tutor, Bangla Typing Software, Google doc, Avro, Bijoy.<br>1.2.2. Install English and Bangla Typing tutor software.<br>1.2.3. Install Bangla Unicode Typing Tutor Software.<br>1.2.4. Install Required fonts for typing of Bangla and English.<br><br>**1.3 Practice text Typing in English and Bangla.**<br>1.3.1 Start Typing tutor software.<br>1.3.2 Practice English Home key drilling systematically.<br>1.3.3 Practice Typing in English as per Standard procedure (30 WPM).<br>1.3.4 Install Specialized Bangla Typing tutor software.<br>1.3.5 Practice systematically Bangla Home key typing.<br>1.3.6 Type Bangla document as per standard procedure (20 WPM).<br>1.3.7 Type Text documents repeatedly to increase typing speed in both English and Bangla.<br><br>**1.3 Maintain the record of the performed job.** | | |
| 2 | **USE THE INTERNET FOR E-COMMUNICATION & INTERACTION**<br><br>**2.1 Access resources from the internet**<br>2.1.1. Interpret ***Internet Terms*** and their uses.<br>***Internet Terms:*** Browser, web page, URL, HTML and http/https, E-mail, social media, IP, Download, Malware, Router, Bookmark, E-commerce<br>2.1.2. Select and install Appropriate ***internet browsers***<br>***Internet browsers:*** Microsoft Edge, Google Chrome, Internet Explorer, Opera, Safari, QQ Browser, UC, Yandex<br>2.1.3. Carry out ***Browser Settings*** for smooth operation.<br>***Browser Settings:*** Synchronization, Privacy and Security, Auto fill, Appearance, Language, Download, Accessibility<br>2.1.4. Open the Internet browser and write/select a web address / URL in /from the address bar to access ***Information.***<br>***Information:*** Text Information, Graphics, Video<br>2.1.5. Use ***Search engines*** to access information.<br>***Search engines:*** Google, Yahoo, Alta Vista, Msn, Bing<br>2.1.6. Use internet resources (Free and Paid Platform)<br>2.1.7. Share/download/upload Video / Information From/to web site/***social media.***<br>***social media:*** Facebook, Twitter, LinkedIn, YouTube<br>2.1.8. Communicate using social media and professional's Media.<br>2.1.9. Search and follow Netiquette' (or web etiquette) Principles.<br><br>**2.2 Use Web Services.** | **4** | **6** |

| | | | |
|---|---|---|---|
| | 2.2.1. Identify ***Web Services*** and service provider as per job requirement.<br>***Web Services:*** Communication (Zoom, Bip, Meet), Storage (Drop box, Mega, One Drive, Google Drive)<br>2.2.2. Interpret the Function of the web services<br>2.2.3. List Information for creating an account in web Services.<br>2.2.4. Identify ***Google services***.<br>***Google services:*** Drive, Calendar, Map, Translator, Docs, Sheets, Slide, Forms, Search, Contact, Classroom, Image Search, Blogger, Meet<br>2.2.5. List Functions of Google services.<br>2.2.6. Demonstrate Google Services.<br><br>**2.3 Use and manage E-mail.**<br>2.3.1 Identify and select ***E-mail services*** to create a new e-mail address. ***E-mail services:*** Free mail services (Gmail, Yahoo, Hotmail), Webmail Services<br>2.3.2 Compose E-mail and attach prepared document.<br>2.3.3 Send E-mail to different types of recipients using the CC and BCC option.<br>2.3.4 Read, forward, reply, and delete E-mail as per requirement.<br>2.3.5 Create and manipulate custom email folders.<br>2.3.6 Print E-mail message.<br><br>**2.4 Maintain the record of the performed job.** | | |
| 3 | **OPERATE A COMPUTER AND ALLIED DEVICES**<br><br>**3.1 Perform Basic Setting**<br>3.1.1 Change power options properties as per requirement.<br>3.1.2 Terminate Non-responding application as specified.<br>3.1.3 Identify and adjust System information, operating system version, date & Time display system, color settings, and available RAM as per job requirement.<br>3.1.4 Set Keyboard Language according to the instructions.<br>3.1.5 Install Fonts following standard procedures.<br>3.1.6 Adjust Screen Resolution as per job requirement.<br>3.1.7 Identify Basic ***Hardware and Software problems*** and take the remedy.<br>***Hardware and Software problem***: Can't Open, Slow, Hang, Display Problem, Setting Problem, Keyboard and Mouse Problem, Sound Problem, Input devices are not working, No network, Slow internet, Printer is not working, Software installation problem<br><br>**3.2Operate Computer**<br>3.2.1 Create Files and folders<br>3.2.2 ***Manipulate*** Files and folders as per requirement.<br>***Manipulated***: Opened, Copied, Renamed, Deleted, Sorted.<br>3.2.3 View and search Properties of files and folders.<br>3.2.4 Practice Control panel settings.<br>3.2.5 Format and defragment ***Storage devices*** as per requirement.<br>***Storage devices***: Hard drive, Flash Drive, Flash Memory<br>3.2.6 Take Backups as required.<br>3.2.7 use and change Password as per job requirement | **3** | **5** |

| | | | |
|---|---|---|---|
| | **3.3 Manage Security of Hardware and Software.**<br>3.3.1 Installed Custom software and Antivirus software according to standard operating procedure.<br>3.3.2 Scan Storage devices using antivirus software.<br>3.3.3 Scan Folders and Files using the current version of Software.<br>3.3.4 Update Scanning software or virus definition regularly.<br>3.3.5 Identify ***Cyber Security issues*** or hardware and software.<br>***Cyber Security issues***: Hacking, Phishing, Data Leakage, Threat<br>3.3.6 Recognize and avoid Cyber threats and attacks.<br><br>**3.4 Manage Printer and Printer settings**<br>3.4.1 Install Printers on the computer according to the manufacturer's instructions.<br>3.4.2 Print Documents from an application.<br>3.4.3 Print, pause, restart, or cancel using print manager.<br><br>**3.5 Maintain the record of performed job** | | |
| 4 | **OPERATE WORD PROCESSING APPLICATION**<br><br>**4.1 Create documents.**<br>4.1.1. Open ***Word-processing application.***<br>***Word-processing application***: MS Word, Open Office<br>4.1.2. Create ***Documents.***<br>(Word documents, Standard CV with different text & Fonts, image, and table, Application / Official letter with proper paragraph and indenting, spacing, styles, illustrations, tables, header & footers and symbols, Standard report/newspaper items with column, footnote, and endnote drop cap, indexing and page numbering)<br>4.1.3. Add Text and Data according to information requirements.<br>4.1.4. Use Document templates as per the job required.<br>4.1.5. Use ***Formatting Tools*** when creating the document.<br>***Formatting Tools***: (Bold, Italic, Underline, Strikethrough, Subscript, Superscript, Change case, Text highlight color, Font color, Font, Font size, Clear formatting, Format painter, Illustrations and styles, Text, Table, Symbols, Header & footer, Text alignment)<br>4.1.6. Insert and edit Equation as per job requirement.<br>4.1.7. Save Documents are as per job requirements.<br><br>**4.2 Customize basic settings to meet page layout conventions**<br>4.2.1 Adjust Page layout to meet information requirements<br>4.2.2 Open and use User interface and ***toolbars*** as per job requirement.<br>***Toolbars:*** File tab, Title bar, Ribbon, Ruler, Status bar, View button, Zoom control, Document area, Dialog box launcher, Backstage view<br>4.2.3 Change ***Font Format*** to suit the purpose of the document.<br>***Font Format:*** Times New Roman, Arial, Nikosh, NikoshBan, Kalpurush, | **8** | **16** |

SutonnyMJ, Century, Century gothic, Vrinda

4.2.4 Change ***Alignment*** and line spacing according to document requirements.

***Alignment:*** Left, Right, Center, Top, Text direction, Cell margins

4.2.5 Modify Margins to suit the purpose of the document.

**4.3 Format documents**

4.3.1 Use formatting features, Symbols, and styles as per requirement.

4.3.2 Highlight and Copy Text from other areas in the document or form another active document.

4.3.3 Insert headers and footers to incorporate necessary data.

4.3.4 Save Documents in another ***file format***

***file format:*** .doc, .docx, .pdf, . xps , .xml

4.3.5 Save and close document to ***Storage device.***

***Storage device***: Flash Drive, Hard Disk Drive, Memory Card, CD/DVD

**4.4 Create a table.**

4.4.1 Insert the standard table into the document.

4.4.2 Split and /or merge the cells to meet the Information requirement.

4.4.3 Insert, delete, modify and move columns and rows if Necessary.

4.4.4 Insert Text into the table.

4.4.5 Operation carried for ***Data Handled*** as per job Requirement.

***Data Handled:*** Sort, Repeat Header row, convert to Text, Formula, Autofit.

4.4.6 Use Styling tools according to style requirements.

4.4.7 Add formula to the table as per job requirement.

**4.5 Add illustrations**

4.5.1 Insert appropriate ***illustrations*** into the document and Customize if necessary.

***Illustrations:*** Picture, clip art, Shapes, Smart Art, Chart

4.5.2 Position and resize images according to the Document formatting requirements.

**4.6 Perform mail merge operation**

4.6.1 Determine sender and recipients as per job Requirements.

4.6.2 Follow preparatory steps for mail merge.

4.6.3 Add recipients for mail merge.

4.6.4 Perform Mail merge operation.

4.6.5 Send mail.

**4.7 Create references**

4.7.1 Plan Footnote, endnote, and citation.

4.7.2 Create Footnote and endnote.

4.7.3 Create citation.

**4.8 Print information**

4.8.1 Connect ***printer*** with computer and power outlet Properly.

***Printer:*** Dot matrix printer, Laser Printer, Inkjet printer

4.8.2 Switch on power at both the power outlet and

| | | | |
|---|---|---|---|
| | printer.<br>4.8.3 Install and add printer.<br>4.8.4 Select correct printer settings and print the document or selected part as per job requirements.<br>4.8.5 View or cancel print from the printer spool.<br><br>**4.9 Maintain the record of the performed job.** | | |
| 5 | **OPERATE SPREADSHEET APPLICATION**<br><br>**5.1 Create spreadsheets**<br>5.1.1. Open ***Spreadsheet Application***,<br>5.1.1. Create spreadsheet files and enter numbers, text, and symbols into cells according to information requirements.<br>5.1.2. Enter simple ***formulas and functions*** using cell Referencing where required.<br>***Formulas:*** SUM, AVERAGE, IF, MAX, MIN, COUNT, RANK, Date and Time, Math and Trig, AND, OR, NOR, Between, ABS, Greater than, less than<br>***Functions:*** Mathematics, Logical, Simple statistical<br>5.1.3. Correct formulas when error messages occur.<br>5.1.4. Use a range of common tools during spreadsheet development.<br>5.1.5. Edit columns and rows within the spreadsheet.<br>5.1.6. Use the auto-fill function to increment data where required.<br>5.1.7. Save spreadsheet file to directory or folder.<br><br>**5.2. Customize basic settings:**<br>5.2.1. Adjust page layout to meet user requirements or special needs.<br>5.2.1. Open and view different toolbars.<br>5.2.2. Change font settings so that they are Appropriate for the purpose of the Document.<br>5.2.3. Change ***alignment*** options and line spacing according to spreadsheet formatting features.<br>***Alignment: Right, Left, Centre, Top, Middle, Bottom***<br>5.2.4. ***Format*** cell to display different styles as required.<br>***Format:*** Bold, Italic, Underline, Font size, color, change case, Alignment, and intend<br>5.2.5. Modify margin sizes to suit the purpose of the spreadsheets.<br>5.2.6. View multiple spreadsheets concurrently.<br><br>**5.3. Format spreadsheet:**<br>5.3.1. Use formatting features as per job requirements.<br>5.3.2. Copy selected formatting features from another cell in the spreadsheet or from another active spreadsheet.<br>5.3.3. Use formatting **tools** as required within the spreadsheet.<br>5.3.4. Align information in a selected cell as required.<br>5.3.5. Insert headers and footers using formatting features.<br>5.3.6. Save the spreadsheet in another format.<br>5.3.7. Save and close the spreadsheet to the storage device.<br><br>**5.4. Sort and filter data in worksheet**<br>5.4.1. Create worksheets.<br>5.4.2. Insert data into the sheet.<br>5.4.3. Sort data with different criteria.<br>5.4.4. Filter data with different conditions,<br>5.4.5. Print sorted or filtered data<br><br>**5.5. Incorporate object and chart in the spreadsheet:** | **6** | **10** |

| | | | |
|---|---|---|---|
| | 5.5.1. Import an object into an active spreadsheet.<br>5.5.2. Manipulate imported objects by using formatting features.<br>5.5.3. Create a chart using selected data in the spreadsheet.<br>5.5.4. Display selected data in a different chart.<br>5.5.5. Modify chart using formatting features.<br><br>**5.6. Create worksheets and charts**<br>5.6.1. Create Worksheets as pre-requirement.<br>5.6.2. Enter Data as per job requirement.<br>5.6.3. use function for calculating and editing logical operations.<br>5.6.4. Format ***Sheets*** as per requirement.<br>***Sheets:*** Salary Sheet with sorting, filtering, and chart, Mark/Grade/Tabulation sheets for simple result processing.<br>5.6.5. Create ***Charts and Graphs*** as per job requirements.<br>***Charts and Graphs:*** Column, Pie, Line, Bar, Table, Scatter<br>5.6.6. Preview and print Charts/ Sheets.<br><br>**5.7. Print spreadsheet:**<br>5.7.1. View spreadsheet in print preview mode.<br>5.7.2. Select basic printer options.<br>5.7.3. Print spreadsheet or selected part of the spreadsheet.<br>5.7.4. Submit the spreadsheet to the appropriate person for approval or feedback.<br><br>**5.8. Maintain the record of the performed job.** | | |
| 6 | **OPERATE PRESENTATION PACKAGE:**<br>**6.1. Create presentations:**<br>6.1.1 Open ***Application package*** for presentation and create a simple design for a presentation according to organizational requirements.<br>***Application package***: PowerPoint, Prezi<br>6.1.2 Open a blank presentation and add text and graphics using the user interface and toolbar.<br>6.1.3 Apply existing styles within a presentation.<br>6.1.4 Use presentation templates and slides to create a presentation.<br>6.1.5 Use various ***Illustrations,*** audio, video, and ***effects*** in the presentation.<br>***Illustrations***: Picture, Clip art, Photo, Shape, Smart art, Chart<br>***Effects***: Entrance, Emphasis, Exit, Motion path, Sound<br>6.1.6 Add design, transition, and animation as per job requirement<br>6.1.7 Save the presentation to the correct directory.<br><br>**6.2 Customize basic settings:**<br>6.2.1 Adjust display to meet user requirements.<br>6.2.2 Open and view different ***toolbars*** to view options.<br>6.2.3 Ensure ***font settings*** are appropriate for the purpose of the presentation.<br>6.2.4 Select necessary font tools as per job requirements.<br>6.2.5 View multiple slides at once.<br><br>**6.3 Format presentation**<br>6.3.1 Use and incorporate organizational charts, bulleted lists and modify as required.<br>6.3.2 Add and manipulate ***objects*** to meet presentation purposes.<br>***Objects***: image, chart, worksheet, equation, slide<br>6.3.3 Import and modify ***objects*** for presentation purposes.<br>6.3.4 Modify slide layout, including text and colors to meet presentation requirements.<br>6.3.5 Use ***formatting tools*** as required within the presentation.<br>6.3.6 Duplicate slides within and/or across a presentation.<br>6.3.7 Record the sequence of slides and/or delete slides for presentation purposes. | **4** | **8** |

| | | | |
|---|---|---|---|
| | ***6.3.8*** Save the presentation in another ***format.***<br>6.3.9 Save and close presentation to disk.<br>**6.4 Add Slide show effects**<br>6.4.1 Incorporate animation and multimedia effects into the presentation as required to enhance the presentation and present the presentation.<br>6.4.2 Add ***Slide transition effect to*** ensure a smooth presentation.<br>6.4.3 Test the presentation for overall impact<br>6.4.4 Use on-screen navigation tools to start and stop slide shows or move between different slides.<br><br>**6.5 Create a template using a master slide**<br>6.5.1 Open Blank presentation and click the slide master form view tab.<br>6.5.2 Create slide layout and/or customized as per requirements.<br>6.5.3 Add Theme based colors, fonts, effects, backgrounds and style to the presentation.<br>6.5.4 Set page orientation for all of the slides.<br>6.5.5 Save and close presentation<br><br>**6.6 Print presentation and notes**<br>6.6.1 Select the appropriate print format to print presentation.<br>6.6.2 Select preferred slide orientation.<br>6.6.3 Add notes and slide numbers.<br>6.6.4 Preview slide and check spells before presentation.<br>6.6.5 Print selected slides.<br><br>**6.7 Maintain the record of performed job.** | | |
| | **Total** | **28** | **50** |

## Necessary Resources (Tools, equipment's and Machinery):

| Sl | Item Name | Quantity |
|---|---|---|
| 01 | Computer System / Laptop | 01 per student |
| | Accessories | |
| 02 | Extra Key Board | 05 Piece |
| 03 | Extra Mouse | 05 Piece |
| 04 | Extra System / Laptop Unit | 02 Piece |
| 05 | Extra Mother Board | 02 Piece |
| 06 | Extra RAM | 05 Piece |
| 07 | Extra Hard Disk | 02 Piece |
| 08 | Extra SSD | 02 Piece |
| 09 | Multimedia Projector | 01 Piece |
| 10 | Multimedia pointer | 01 Piece |
| 11 | Potable wireless Sound System | 01 set |
| 12 | Network Adapter | 02 Piece |
| 13 | VGA cable | 02 Piece |
| 14 | Printer (LASER) | 01 Piece |
| 15 | Printer (Dot Matrix ) | 01 Piece |
| 16 | Printer (Inkjet) | 01 Piece |
| 17 | Printer Cable | 01 Piece |
| 18 | Monitor | 01 Piece |
| 19 | Modem | 01 Piece |
| 20 | Scanner | 01 Piece |

| | | |
|---|---|---|
| 21 | Power cords/Power adapter | 01 Piece |
| 22 | UPS/ IPS | 01 Piece |

**Recommended Books:**

| Sl | Book Name | Writer Name | Publisher Name & Edition |
|---|---|---|---|
| **01** | MOS 2010, Study Guide | Joan ambert, Joyce Cox | **Up-to-date Edition** |
| 02 | Computer Application in Business | R. Parameswaran | |

**Website References:**

| Sl | Web Link | Remarks |
|---|---|---|
| **01** | **https://teachers.tech/microsoft-office-tutorials/** | |
| **02** | **https://www.javatpoint.com/ms-word-tutorial** | |
| **03** | **https://www.tutorialspoint.com/word/index.htm** | |

| Subject Code | Subject Name | Period Per Week | | Credit |
|---|---|---|---|---|
| 27041 | Engineering Mechanics | T | P | C |
| | | 2 | 3 | 3 |

| | |
|---|---|
| **Rationale** | Engineering mechanics is the branch of Applied Mechanics. Applied mechanics is the part of science concerned with the motion of any substance, examining bodies' response to external forces. In Mechanical Engineering it can be applied in mechatronics and robotics, design and drafting, nanotechnology, machine elements, structure analysis, and aerospace engineering.<br>The Student with a Diploma in Mechanical Engineering Level must be acquired basic knowledge about calculation, applications, and mandatory analysis of Engineering Mechanics. Also required basic knowledge of newly introduced Mechanical technology and other related analysis & calculation. For self-development must be updated with the latest technology.<br>After successfully completing this course, students will be able to identify the Fundamental of mechanics and unit conversion, Composition and resolution of forces, Moment of forces, Couples and their applications, Equilibrium of forces, Center of gravity, Friction, Support reactions force of beam and truss, the moment of inertia, gear trains, and its application. |
| **Learning Outcome (Theoretical)** | At the end of the course, the students will be able to:<br>▪ State the fundamental of units and conversions of units<br>▪ State the force, effect of the force, composition, and resolution of forces and compute the resultant force<br>▪ State Moment of force & couple<br>▪ State the parallel forces<br>▪ State the centroid and enable computing the center of gravity & the moment of inertia<br>▪ Illustrate laws of friction and the coefficient of friction & the ability to compute frictional forces of reactions of surfaces<br>▪ Derive support reactions and describe types of loading on beams and trusses.<br>▪ State gear trains |
| **Learning Outcome (Practical)** | At the end of the course, the students will be able to:<br>▪ Determine the resultant force by using the force board<br>▪ Determine the compression load using a Jib crane<br>▪ Determine the equilibrium force by using the force table<br>▪ Determine the center of a triangular & rectangular lamina<br>▪ Determine the center of gravity of a solid body<br>▪ Determine the coefficient of friction<br>▪ Determine the action of load on the member of a simple frame or trusses<br>▪ Determine the balancing of the moment<br>▪ Determine the velocity ratios among the driver and driven gears |

# Detailed Syllabus (Theory)

| Unit | Topics with contents | Class (1 Period) | Final Marks |
|---|---|---|---|
| **1** | **FUNDAMENTAL OF MECHANICS**<br>1.1 Define mechanics<br>1.2 Mention the Sub-Divisions of Engineering Mechanics<br>1.3 State Importance of Units in the engineering field<br>1.4 Discuss the conversion of units<br>1.5 Illustrate algebra, trigonometry & calculus used in mechanics | 2 | 2 |
| **2** | **COMPOSITION AND RESOLUTION OF FORCES**<br>2.1. State the effect and characteristics of a force<br>2.2. Describe the different systems of forces<br>2.3. Describe the resultant force and composition of forces<br>2.4. State resultant force graphically and analytically<br>2.5. State the laws of forces<br>2.6. Define the resolution of a force<br>2.7. Deduce the formula to find the rectangular components<br>2.8. Describe the magnitude and position of the resultant force graphically and analytically<br>2.9. Solve the problems related to the resultant force | 4 | 8 |
| **3** | **MOMENT OF FORCES AND COUPLES**<br>3.1 Define the moment of force<br>3.2 Mention the units of moment<br>3.3 Mention the clockwise and anticlockwise moment<br>3.4 State Varignon's principle of moments<br>3.5 Define lever and Couple<br>3.6 State Classification of parallel forces<br>3.7 Classify Lever and couple<br>3.8 Solve the problems related to the moment of forces and couple | 3 | 6 |
| **4** | **EQUILIBRIUM OF FORCES**<br>4.1. State the principles of equilibrium forces<br>4.2. State Lami's theorem<br>4.3. Derive Lami's theorem<br>4.4. Describe different methods of the equilibrium of coplanar forces and non-coplanar forces<br>4.5. Explain the conditions of equilibrium<br>4.6. Mention the types of equilibrium of forces<br>4.7. Solve the problems related to the equilibrium of forces | 3 | 6 |
| **5** | **CENTER OF GRAVITY**<br>5.1 Define center of gravity and centroid<br>5.2 Distinguish between the center of gravity and centroid<br>5.3 Explain the methods to find out the centroid of the simple geometrical figure<br>5.4 Illustrate the axis of reference and axis of symmetry | 3 | 6 |

| | | | |
|---|---|---|---|
| | 5.5 Find out the centroid of a rectangle, triangle and semicircle by using geometrically and integration method<br>5.6 Find out the centroid of the plain geometrical figure by the principle of first moments<br>5.7 Calculate the centroid of the different geometric figure<br>5.8 Calculate the center of gravity of solid bodies<br>5.9 Solve the problems related to the center of gravity | | |
| **6** | **MOMENT OF INERTIA**<br>6.1 Describe the moment of inertia and the units of the moment of inertia<br>6.2 Describe the methods to find out the moment of inertia<br>6.3 Find the moment of inertia of simple areas by the method of integration<br>6.4 State and proof of the theorem of the perpendicular axis as applied to the moment of inertia<br>6.5 State the parallel axis theorem in the determination of the moment of inertia of areas<br>6.6 Explain the radius of gyration and section modulus<br>6.7 Define mass moment of inertia<br>6.8 Mention the Application of mass moment of inertia<br>6.9 Calculate and Solve the problems related to the moment of inertia and section modulus of composite sections and simple solid bodies | 4 | 8 |
| **7** | **FRICTION**<br>7.1 Define friction<br>7.2 Describe the advantages and disadvantages of friction<br>7.3 Mention the types of friction<br>7.4 State the laws of static and dynamic friction<br>7.5 Explain the angle of friction<br>7.6 Explain the classification of the co-efficient of friction<br>7.7 Explain free body diagrams of a body lying on horizontal, inclined and vertical surfaces, ladder and wedge<br>7.8 Calculate the frictional force of a body lying on horizontal and inclined surfaces<br>7.9 Describe the methods to solve the problems of ladder and wedge<br>7.10 Solve the problems related to friction | 4 | 6 |
| **8** | **SUPPORT REACTION FORCES ON BEAM**<br>8.1 Define beam<br>8.2 Define support and support reactions<br>8.3 Classify supports<br>8.4 Describe different types of beams<br>8.5 Explain different types of loads on the beam<br>8.6 Calculate the support reactions of simple, overhanging and cantilever beam with different loading conditions<br>8.7 Solve the problems related to support reaction forces on the beam | 3 | 6 |
| **9** | **SUPPORT REACTION FORCES ON TRUSS**<br>9.1 Define truss | 3 | 6 |

| | | | |
|---|---|---|---|
| | 9.2 Classify truss<br>9.3 Describe perfect and imperfect truss<br>9.4 State the method to find out the support reaction and forces on the member of the truss<br>9.5 Mention the nature of force on the members of the truss<br>9.6 Solve the problem-related with truss | | |
| **10** | **GEAR TRAINS**<br>10.1 Define gear<br>10.2 Mention the types of gear<br>10.3 Define gear train<br>10.4 Classify gear train<br>10.5 State simple, compound, and epicyclical gear train<br>10.6 Express the velocity ratio of the simple, compound and epicyclical gear train<br>10.7 Solve the problems related to gear trains | 3 | 6 |
| | **Total** | **32** | **60** |

## Detailed Syllabus (Practical)

| Sl. | Experiment name with the procedure | Class (3 Period) | Continuous Marks |
|---|---|---|---|
| **1** | **DETERMINE THE RESULTANT FORCE BY USING THE FORCE BOARD**<br>1.1 Set up the force board<br>1.2 Set up the accessories on the force board<br>1.3 Find the resultant force<br>1.4 Calculate the magnitude of the resultant force<br>1.5 Perform the Comparison of calculated values with experimental values<br>1.6 Maintain the record of the performed task | 1 | 2 |
| **2** | **DETERMINE THE FORCES IN THE MEMBERS OF A JIB CRANE**<br>2.1 Set up the Jib crane<br>2.2 Set up the accessories on the Jib crane<br>2.3 Find the compression loads on the Jib<br>2.4 Calculate the compression analytically<br>2.5 Compare the experimental values with analytical values<br>2.6 Maintain the record of the performed task | 1 | 3 |
| **3** | **DETERMINE THE EQUILIBRIUM FORCE BY USING THE FORCE TABLE**<br>3.1 Set up the force table<br>3.2 Set up the accessories on the force table<br>3.3 Find the magnitude and direction of a force establishing equilibrium<br>3.4 Calculate the magnitude and direction of the equilibrium force<br>3.5 Compare the calculated values with experimental values<br>3.6 Maintain the record of the performed task | 2 | 3 |
| **4** | **DETERMINE THE CENTER OF A TRIANGULAR LAMINA**<br>4.1 Select a triangular lamina and a plumb bob<br>4.2 Set up the plumb bob<br>4.3 Find the center point of the triangular lamina | 1 | 3 |

| | | | |
|---|---|---|---|
| | 4.4 Maintain the record of the performed task | | |
| **5** | **DETERMINE THE CENTER OF A RECTANGULAR LAMINA**<br>5.1. Select a rectangular lamina and a plumb bob<br>5.2. Set up the plumb bob<br>5.3. Find the center point of the rectangular lamina<br>5.4. Maintain the record of the performed task | 1 | 2 |
| **6** | **DETERMINE THE CENTER OF GRAVITY OF A SOLID BODY**<br>6.1. Select a solid rod, step rod, and body with cut-out holes of solid bodies<br>6.2. Select a fulcrum<br>6.3. Set up the fulcrum<br>6.4. Find the center point<br>6.5. Compare the analytical values with experimental values<br>6.6. Maintain the record of the performed task | 2 | 3 |
| **7** | **DETERMINE THE COEFFICIENT OF FRICTION**<br>7.1 Set up the friction apparatus<br>7.2 Select the materials of which the coefficient of friction is to be determined<br>7.3 Place the materials over each other<br>7.4 Raise one end of the body until the other body slides down<br>7.5 Find the angle of friction<br>7.6 Find the coefficient of friction<br>7.7 Maintain the record of the performed task | 2 | 3 |
| **8** | **DETERMINE THE ACTION OF LOAD ON THE MEMBER OF A SIMPLE FRAME OR TRUSS**<br>8.1 Select two members of which one end roller and the other end pinpoint<br>8.2 Select a tension spring<br>8.3 Make a unit as a simple frame or truss<br>8.4 Apply the load<br>8.5 Read the tension load on the spring<br>8.6 Maintain the record of the performed task | 2 | 2 |
| **9** | **DETERMINE THE BALANCING OF THE MOMENT**<br>9.1 Set up the bell crank lever<br>9.2 Set up the accessories on the bell crank lever<br>9.3 Compare the clockwise and anticlockwise moment<br>9.4 Read tension on the spring balance<br>9.5 Compare the experimental values with analytical values<br>9.6 Maintain the record of the performed task | 2 | 2 |
| **10** | **DETERMINE THE VELOCITY RATIOS AMONG THE DRIVER AND DRIVEN GEARS**<br>10.1 Set a simple train of gears<br>10.2. Compare the velocity ratios of the same<br>10.3. Set a compound train of gears<br>10.4. Compare the velocity ratios of the same | 2 | 2 |

| | | | |
|---|---|---|---|
| | 10.5. Maintain the record of performed task | | |
| | **Total** | **16** | **25** |

## Necessary Resources (Tools, equipment and Machinery):

| Sl. | Item Name | Quantity |
|---|---|---|
| 01 | Forces Kit including Work Panel | Each item 5 Set |
| 02 | Friction and Inclined Plane Kit including Work Panel | Each item 5 Set |
| 03 | Gear Trains Kit including Work Panel | Each item 5 Set |
| 04 | Equilibrium of Forces including Statics Works Panel | Each item 5 Set |
| 05 | Pin Jointed Frameworks | Each item 5 Set |
| 06 | Laptop, Multimedia & Hi-speed internet connection. | Each item 2 Nos |

## Recommended Books:

| Sl | Book Name | Writer Name | Publisher Name & Edition |
|---|---|---|---|
| 01 | Applied Mechanics | R. S. Khurmi, J.K Gupta | 14th Edition& S. Chand & Company Ltd. |
| 02 | Engineering Mechanics | Russell Hibbeler | 14th Edition& |
| 03 | A Textbook of Applied Mechanics | R. K. Rajput | 4th Edition, Kindle Edition |

| Sl | Web Link for Books | Remarks |
|---|---|---|
| 01 | Applied Mechanics Dynamics | https://www.pdfdrive.com/applied-mechanics-dynamics-d5674220.html |
| 02 | A Textbook of Engineering Mechanics | https://books.google.com.bd/url?id=AKEbEAAAQBAJ&pg=PP4&q=http://www.schandpublishing.com&linkid=1&usg=AOvVaw0UntnjOxMDuTPARpClepDF&source=gbs_pub_info_r |
| 03 | Applied Mechanics | https://www.researchgate.net/publication/340999448_Applied_Mechanics |
| 04 | Applied Mechanics | https://www.youtube.com/watch?v=4-oZM1TYjyQ |

## Website References:

| Sl | Web Link | Experiment name with the procedure | Remarks |
|---|---|---|---|
| 01 | https://www.youtube.com/watch?v=PYv8cGQrZN8 | Determination of Force and Centre of Gravity | |
| 02 | https://www.youtube.com/watch?v=n1JTt_7BS80 | Determination of Friction | |
| 03 | https://www.youtube.com/watch?v=mUUCh7ocsvs | Determination of Gear Ratio, Efficiency | |
| 04 | https://www.youtube.com/watch?v=jmL-mcjXxHQ | Determination of Equilibrium of Forces | |
| 05 | https://www.youtube.com/watch?v=maIARO_euBo | Determination of Forces and deflections in different frameworks | |
| | https://youtu.be/U5MMgLfSHvA | Determine The Balancing of The Moment | |