



BANGLADESH TECHNICAL EDUCATION BOARD

Agargaon, Dhaka-1207.

**4-YEAR DIPLOMA IN TEXTILE ENGINEERING CURRICULUM
COURSE STRUCTURE & SYLLABUS
(PROBIDHAN-2022)**

**WET PROCESSING
TECHNOLOGY CODE: 13**

**6th SEMESTER
(Effective from 2023-2024 Academic Sessions)**

DIPLOMA IN TEXTILE ENGINEERING
COURSE STRUCTURE
PROBIDHAN-2022
WET PROCESSING (13)

Wet Processing (13)

6th Semester

| Sl. No. | Subject | | Period Per Week | | Credit | Marks Distribution | | | | | | Grand Total |
|---------------------------------|---------|---|-----------------|--------------|-----------|--------------------|------------|------------|----------------------|------------|------------|--------------|
| | | | | | | Theory Assessment | | | Practical Assessment | | | |
| | Code | Name | Theory | Practical | | Continuous | Final | Total | Continuous | Final | Total | |
| 1 | 21161 | Textile Testing & Quality Control-II | 3 | 3 | 4 | 60 | 90 | 150 | 25 | 25 | 50 | 200 |
| 2 | 21362 | Advanced Wet Processing -I | 2 | 3 | 3 | 40 | 60 | 100 | 25 | 25 | 50 | 150 |
| 3 | 21363 | Textiles Printing | 2 | 3 | 3 | 40 | 60 | 100 | 25 | 25 | 50 | 150 |
| 4 | 21364 | Textile Finishing | 2 | 3 | 3 | 40 | 60 | 100 | 25 | 25 | 50 | 150 |
| 5 | 21365 | Application of Computer in Textile Wet Processing | 0 | 6 | 2 | - | - | - | 50 | 50 | 100 | 100 |
| 6 | 25851 | Principle of Marketing | 2 | 0 | 2 | 40 | 60 | 100 | - | - | - | 100 |
| 7 | 29041 | Environmental Studies | 2 | 3 | 3 | 40 | 60 | 100 | 25 | 25 | 50 | 150 |
| Total | | | 13 | 21 | 20 | 260 | 390 | 650 | 175 | 175 | 350 | 1,000 |
| Total Period | | | | | 34 | | | | | | | |
| Theory:Practical (Ratio) | | | 38.2% | 61.8% | | | | | | | | |

| Subject Code | Subject Name | Period Per Week | | Credit |
|--------------|--|-----------------|---|--------|
| 21161 | Textile Testing and Quality Control II | T | P | C |
| | | 3 | 3 | 4 |

| | |
|---------------------------------------|---|
| Rationale | There are mainly four major products of textile manufacturing such as fiber, yarn, fabric and apparel. Maintaining acceptable quality standard of these textile materials is indispensable to meet the growing demand of stakeholders. Therefore, a textile engineer must know how to assess quality in addition to the knowledge of textile manufacturing. Textile Testing and Quality Control II is designed to incorporate and demonstrate industrially practiced different tests involved in fabric and apparel. |
| Learning Outcome (Theoretical) | <p>After completion of this course, students will be able to:</p> <ul style="list-style-type: none"> - Explain the composition of fabric - Interpret fabric specification - Explain different types of fabric strength - Discuss air and water permeability of fabric - Discuss crease resistance and recovery of fabric - Discuss drape and stiffness of fabric - Explain abrasion and pilling resistance - Discuss dimensional stability of fabric - Explain color fastness and color assessment of fabric - Discuss seam strength, button strength, zipper strength testing - Explain pH testing of apparel - Describe standard testing procedure |
| Learning Outcome (Practical) | <p>After completion of this course, students will be able to:</p> <ul style="list-style-type: none"> - Identify fabric specification - Determine crimp percentage - Measure fabric strength - Measure permeability - Measure crease resistance and crease recovery - Measure drape co-efficient of fabric - Measure abrasion and pilling resistance - Assess different color fastness - Measure seam strength |

Detailed Syllabus (Theory)

| Unit | Topics with Contents | Class (1 Period) | Final Marks |
|------|--|---------------------|----------------|
| 1 | Fabric Testing 1.1 Define fabric testing. 1.2 Describe the purposes of fabric testing. 1.3 List the tests involved in fabric testing. 1.4 List the tests involved in apparel testing. | 2 | 2 |
| 2 | Fabric Composition Test 2.1 Discuss the importance of fabric composition test. 2.2 List the modern methods of fabric composition test. 2.3 Describe solubility behavior of fibers in the fabrics. 2.4 State flammability behavior of fabrics. | 3 | 4 |
| 3 | Physical Properties of Fabric 3.1 Describe the methods of GSM testing. 3.2 Define EPI, PPI, CPI and WPI. 3.3 Mention the precautions of fabric thickness measurement. 3.4 List the instruments of fabric thickness measurement. 3.5 State the testing procedure of fabric thickness. 3.6 Define crimp. 3.7 State the effect of crimp on fabric properties. 3.8 Discuss the factors to be considered during crimp measurement. 3.9 Describe the method of crimp measurement. 3.10 Define cover factor. | 4 | 8 |
| 4 | Fabric Strength 8.1 State the importance of fabric strength measurement. 8.2 Describe different methods of tensile strength test. 8.3 State the factors affecting tensile strength. 8.4 Describe different methods of tearing strength test. 8.5 State the factors affecting tearing strength. 8.6 Describe methods of bursting strength test. 8.7 State the factors affecting bursting strength. | 4 | 8 |
| 5 | Air Permeability 4.1 Define air permeability. 5.2 State the importance of air permeability. 5.3 Describe the method of measuring air permeability. 5.4 Discuss the factors affecting air permeability. | 2 | 4 |

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|----|---|---|---|
| 6 | <p>Water Permeability</p> <p>6.1 Define water permeability.</p> <p>6.2 State the importance of water permeability.</p> <p>6.3 Define absorbency, shower proof, water proof, wetting and water repellency.</p> <p>6.4 Discuss methods of measuring water resistance of a fabric.</p> <p>6.5 Discuss the factors affecting water permeability.</p> | 3 | 5 |
| 7 | <p>Fabric Crease</p> <p>7.1 Define crease.</p> <p>7.2 Define crease resistance.</p> <p>7.3 Define crease recovery.</p> <p>7.4 Mention the effects of crease.</p> <p>7.5 Describe the methods of measuring crease recovery.</p> | 2 | 4 |
| 8 | <p>Drape, Stiffness and Handle of Fabric</p> <p>8.1 Define drape, stiffness and handle of fabric.</p> <p>8.2 Describe method of measuring drape.</p> <p>8.3 Define bending length and flexural rigidity.</p> <p>8.4 Mention methods of stiffness measurement.</p> <p>8.5 Describe the method of stiffness measurement by Shirley stiffness tester.</p> <p>8.6 Define Kawabata testing.</p> | 4 | 6 |
| 9 | <p>Abrasion and Pilling</p> <p>9.1 Define abrasion resistance.</p> <p>9.2 Mention the types of abrasion.</p> <p>9.3 Describe the methods of measuring abrasion resistance.</p> <p>9.4 Define serviceability.</p> <p>9.5 Mention the purpose of serviceability test.</p> <p>9.6 Define pilling.</p> <p>9.7 Describe the mechanism of pill formation.</p> <p>9.8 List the instruments used in pilling test.</p> <p>9.9 Describe the methods of pilling test.</p> | 3 | 7 |
| 10 | <p>Dimensional Stability of Fabric</p> <p>10.1 Define fabric shrinkage.</p> <p>10.2 Mention the types of shrinkage.</p> <p>10.3 State the methods of shrinkage measurement.</p> <p>10.4 Define fabric wrinkle.</p> <p>10.5 Discuss the method of fabric wrinkle test.</p> <p>10.6 Describe the method of fabric dimensional stability test.</p> <p>10.7 Define fabric spirality.</p> <p>10.8 Describe the method of spirality test.</p> | 4 | 8 |

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| 11 | <p>Color Fastness Tests</p> <p>11.1 Define color fastness.</p> <p>11.2 Mention types of color fastness.</p> <p>11.3 Describe significance of color fastness test.</p> <p>11.4 State the method of color fastness to rubbing/crocking.</p> <p>11.5 Describe the method of color fastness to wash.</p> <p>11.6 State the method of color fastness to light.</p> <p>11.7 Describe the method of color fastness to perspiration.</p> | 3 | 7 |
| 12 | <p>Color Assessment</p> <p>12.1 Describe spectrophotometer/data color.</p> <p>12.2 Discuss the importance of spectrophotometer.</p> <p>12.3 Mention components of spectrophotometer.</p> <p>12.4 List the quality attributes assessed by spectrophotometer.</p> <p>12.5 Mention the uses of grey scale and blue wool scale.</p> | 3 | 5 |
| 13 | <p>Apparel Testing</p> <p>13.1 List the tests involved in apparel.</p> <p>13.2 State seam strength and seam slippage test.</p> <p>13.3 Describe button strength test.</p> <p>13.4 Describe zipper strength test.</p> <p>13.5 Explain needle detection test.</p> <p>13.6 Describe pH testing process of apparel.</p> | 4 | 8 |
| 14 | <p>Functional Testing for Fabric and Apparel</p> <p>14.1 Define functional test.</p> <p>14.2 Discuss importance of functional test of specialized fabric and apparel.</p> <p>14.3 Define biological test.</p> <p>14.4 Define physiological test.</p> <p>14.5 Define technical textiles.</p> <p>14.6 Mention tests for technical textiles.</p> | 3 | 6 |
| 15 | <p>Testing Standards and Certifications</p> <p>15.1 Define testing standard.</p> <p>15.2 Discuss the significance of standard testing procedure.</p> <p>15.3 Discuss BDS (Bangladesh Standard) and IS (Indian Standard).</p> <p>15.4 Discuss ISO (International Organization for Standardization).</p> <p>15.5 Discuss ASTM (American Society for Testing and Materials) and AATCC (American Association of Textile Chemist and Colorist).</p> <p>15.6 Discuss BS (British Standard).</p> <p>15.7 State the importance of ISO certification.</p> <p>15.8 Describe the steps of awarding ISO certification.</p> <p>15.9 State the objective of ISO 9001:2008, ISO 37001, ISO 31000 and ISO 27001.</p> | 4 | 8 |

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| | Total | 48 | 90 |
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Detailed Syllabus (Practical)

| Sl | Experiment name with procedure | Class (3 period) | Continuous Marks |
|----|--|---------------------|---------------------|
| 1 | Observe Mass Per Unit Area (GSM) of Fabric 1.1 Prepare the sample for measuring GSM. 1.2 Calculate the GSM of fabric by using GSM cutter. 1.3 Maintain the record of the performed experiment. | 1 | 2.5 |
| 2 | Observe Thickness of Fabric 2.1 Prepare the sample for measuring fabric thickness. 2.2 Calculate the fabric thickness by thickness tester. 2.3 Maintain the record of the performed experiment. | 1 | 2.5 |
| 3 | Observe Threads per Unit Length of Fabric 3.1 Prepare the sample for measuring EPI and PPI. 3.2 Find out EPI and PPI using counting class and needle. 3.3 Maintain the record of the performed experiment. | 2 | 2.5 |
| 4 | Perform Different Strength Test of Fabric 5.1 Prepare the samples for strength testing. 5.2 Measure tensile strength of woven fabric. 5.3 Measure tearing strength of woven fabric. 5.4 Measure bursting strength of knit fabric. 5.5 Maintain the record of the performed experiment. | 2 | 2.5 |
| 5 | Observe Permeability of Fabric 6.1 Prepare the sample for permeability testing. 6.2 Determine water permeability of fabric. 6.3 Determine air permeability of fabric. 6.4 Maintain the record of the performed experiment. | 1 | 2 |
| 6 | Determine Crease Recovery & Crimp of Fabric 7.1 Prepare the sample for measuring crease & Crimp 7.2 Determine crease recovery and crimp of fabric. 7.3 Maintain the record of the performed experiment. | 2 | 4 |
| 7 | Observe Drape and Stiffness of Fabric 8.1 Prepare the sample for measuring drape and stiffness. 8.2 Perform drape and stiffness test of fabric. 8.3 Maintain the record of performed experiment. | 1 | 2 |
| 8 | Determine Abrasion and Pilling Resistance of Fabric 9.1 Prepare the sample for measuring abrasion and pilling. 9.2 Determine abrasion and pilling resistance of given fabric. 9.3 Maintain the record of the performed experiment. | 2 | 2 |
| 9 | Assess Color Fastness Properties of Fabric 10.1 Prepare the sample for checking color fastness. 10.2 Measure color fastness to wash. 10.3 Measure color fastness to rubbing. 10.4 Measure color fastness to perspiration. 10.5 Measure color fastness to light. 10.6 Maintain the record of the performed experiment. | 3 | 3 |

| | | | |
|----|--|----|----|
| 10 | Observe Seam Strength and Seam Slippage of Apparel 11.1 Prepare the sample for measuring seam strength and seam slippage. 11.2 Determine seam strength and seam slippage of apparel. 11.3 Maintain the record of performed experiment. | 1 | 2 |
| | Total | 16 | 25 |

Necessary Resources (Tools, Equipment and Machinery):

| Sl | Item Name | Quantity (piece/s) |
|----|---|--------------------|
| 01 | GSM cutter | 1 |
| 02 | Counting glass | 15 |
| 03 | Needle | 15 |
| 04 | Digital thickness gauze | 1 |
| 05 | Crimp tester | 1 |
| 06 | Drape tester | 1 |
| 07 | Wrinkle tester | 1 |
| 08 | Pilling tester | 1 |
| 09 | Abrasion tester | 1 |
| 10 | Crease recovery tester | 1 |
| 11 | Spectrophotometer | 1 |
| 12 | Multi-fiber fabric | 2 box |
| 13 | Rubbing cloth | 2 box |
| 14 | Bloating paper | 100 pcs |
| 15 | Digital balance | 1 |
| 16 | Crocking meter | 1 |
| 17 | Knit fabric | 25 kg |
| 18 | Woven fabric | 25 kg |
| 19 | Air permeability tester | 1 |
| 20 | Water permeability tester | 1 |
| 21 | Tensile strength tester | 1 |
| 22 | Tearing strength tester | 1 |
| 23 | Bursting strength tester | 1 |
| 24 | Shaker machine for p ^H testing | 1 |
| 25 | p ^H Meter | 1 |
| 26 | Conical flask | 12 |
| 27 | Beaker (Different size) | 12 |
| 27 | Pipette | 10 |
| 29 | Glass rod | 10 |
| 30 | Sulfuric Acid | 500 ml |
| 31 | Acetone | 500 ml |
| 32 | Hydrochloric acid | 500 ml |
| 33 | Chlorine bleach | 500 ml |
| 34 | Formic acid | 500 ml |
| 35 | Sodium chloride | 1 kg |
| 36 | Sodium hydroxide | 500 ml |

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| 37 | Sodium dihydrogen phosphate dihydrate | 500 g |
| 38 | Disodium hydrogen phosphate dihydrate | 500 g |
| 39 | L-histidine hydrochloride-hydrate | 500 g |
| 40 | Perspiration fastness tester | 01 |
| 41 | Color assessment cabinet (light box) | 01 |
| 42 | Gray scale | 2 pcs |
| 43 | Buffer solution 4,7,10 | 1 L each |
| 44 | Potassium chloride | 1 kg |

Recommended Books:

| Sl | Book Name | Writer Name | Publisher Name & Edition |
|----|---------------------------------------|----------------------|--|
| 01 | Principles of Textile Testing | <u>John E. Booth</u> | Butterworths, 2012 |
| 02 | Fabric Testing | Jinlian HU | Woodhead Publishing Limited, 2008 |
| 03 | Textile Testing: Fibre, Yarn & Fabric | <u>Arindam Basu</u> | South India Textile Research Association, 2006 |
| 04 | টেস্টিং অব টেক্সটাইলস | আ. ক. ম. ফরিদুল আজাদ | <u>Books Fair Publications</u> , 2009 |

Website References:

| Sl | Web Link | Remarks |
|----|--|---------|
| 01 | www.youtube.com | |
| 02 | www.nptel.com | |

Prepared By: -

Suman Modak
Junior Instructor (Technical)
Textile Engineering College, Chattogram.

Md Sultan Hossain
Deputy Secretary, Bangladesh
Technical Education Board, Dhaka

Jannaatul Ferdous
Assistant Lab Chemist
Standard Group, Dhaka

Md. Rashel Hawlader
Senior Lecturer
Northern University Bangladesh

Dr. S M Fijul Kabir
Assistant Professor in Textile
Engineering, and Head of Industrial

Helal Uddin
Associate Prof. & Director IQAC
Primeasia University

and Production Engineering,
National Institute of Textile
Engineering and Research (NITER),
Savar, Dhaka

Validated By:-

Engr. Md. Nasir Uddin

Principal

Begum Amina Mansoor Textile Engineering Institute, Kazipur,
Sirajganj

Md. Gulzer Hossain

Senior Instructor, Bangladesh Handloom Education and
Training Institute, Narshingdi.

| Subject Code | Subject Name | Period Per Week | | Credit |
|--------------|---------------------------|-----------------|---|--------|
| 21362 | ADVANCED WET PROCESSING-I | T | P | C |
| | | 2 | 3 | 3 |

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|---------------------------------------|---|
| Rationale | <p>This course is designed to enrich students with the knowledge of various dyes, chemicals, auxiliaries and machineries used in the field of wet processing. Wet processing includes vast areas of textile process where the science behind the dyes, chemicals and auxiliaries; various application methods and working procedures of relevant machineries are very important. While fabric dyeing both knit and woven comprises the major portion of textile dyeing, yarn and garments dyeing are also getting considerable attention and the market volume is rising gradually. That's why, dyeing of yarn and garments, along with the fabric dyeing are included in this course. Dyeing industries are always in need of textile engineers and technologists with sufficient skill, knowledge and attitude to run the operations smoothly as well as meet the expectations of the ever changing market and advanced technologies. This course will help students to gain the skills, knowledge and attitude necessary to meet the demand of the industries which in turns help the economy and the country as well.</p> |
| Learning Outcome (Theoretical) | <p>After completion of this course, students will be able to:</p> <ol style="list-style-type: none"> 1. Interpret different dyes, chemicals and auxiliaries used in wet processing 2. Clarify the process sequence of wet processing 3. Formulate recipe to obtain given shade 4. Interpret different dyestuffs, chemical & auxiliaries based on their compatibility with various fibrous materials 5. Assess special preparation required before dyeing 6. Illustrate special preparation required after dyeing 7. State the requirements and technology of garments dyeing 8. Explain the requirements and technology of yarn dyeing |
| Learning Outcome (Practical) | <p>After completion of this course, students will be able to:</p> <ol style="list-style-type: none"> 1. Identify different dyes, chemicals and auxiliaries used in dyeing operation 2. Identify the process sequence for particular dyeing operation 3. Plan a dyeing process with required dyes and chemicals and appropriate dyeing machinery 4. Calculate the amount of relevant dyes, chemicals and auxiliaries to carry out efficient dyeing operation 5. Follow the precautions should be taken in dyeing process 6. Prepare the plan for a production |

Detailed Syllabus (Theory)

| Unit | Topics with Contents | Period (1 Period) | Final Marks |
|------|--|-------------------------|----------------|
| 1 | Acid Dyes 1.1 Define Acid dye 1.2 Classify Acid dye 1.3 State the properties of Acid dyes 1.4 List out the commercial names of Acid dye 1.5 State dyeing procedure of Nylon with Acid dye 1.6 Describe the dyeing procedure of Wool with Acid dye 1.7 Describe the after-treatment procedure of Acid dye | 3 | 6 |
| 2 | Basic Dyes 2.1 Define Basic dye 2.2 Classify Basic dye 2.3 State the properties of Basic dye 2.4 List out the commercial names of Basic dye 2.5 Describe the scope of cotton dyeing with Basic dye 2.6 State the dyeing procedure of Jute with Basic dye 2.7 Describe the dyeing procedure of Acrylic with Basic dye | 3 | 6 |
| 3 | Azoic Dyes 3.1 Define Azoic dye 3.2 State the properties of Azoic dye 3.3 Describe the steps of dyeing with Azoic dye 3.4 List out the commercial names of Azoic dye 3.5 Describe the dyeing procedure of cotton with Azoic dye 3.6 Explain the after-treatment procedure of Azoic dye | 2 | 6 |
| 4 | Pigments 4.1 Define Pigment 4.2 State the properties of Pigment 4.3 List out the commercial names of Pigment 4.4 Classify Pigment 4.5 State merits & demerits of pigment 4.6 Mention the function of binder and fixer 4.7 Describe the dyeing procedure of cotton with Pigment | 4 | 6 |

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|---|---|---|---|
| 5 | <p>Indigo Dyes</p> <p>5.1 Define Indigo dye</p> <p>5.2 Classify Indigo dye</p> <p>5.3 State the properties of Indigo dye</p> <p>5.4 List out the commercial names of Indigo dye</p> <p>5.5 Mention the dyeing methods with Indigo dye</p> <p>5.6 State the steps of Indigo dyeing process</p> <p>5.7 Describe the Rope form Dyeing method for denim with Indigo dye</p> | 3 | 6 |
| 6 | <p>Solvent Dyes</p> <p>6.1 Define Solvent dye</p> <p>6.2 State the necessity of Solvent Dyeing</p> <p>6.3 Classify Solvent dye</p> <p>6.4 State the properties of Solvent dye</p> <p>6.5 List out the commercial names of Solvent dye</p> <p>6.6 Describe the Dyeing procedure of polyester with Solvent dye</p> <p>6.7 Explain the After-treatment procedure of Solvent dye</p> | 2 | 6 |
| 7 | <p>Natural Dyes</p> <p>7.1 Define Natural dye</p> <p>7.2 State the properties of Natural dyes</p> <p>7.3 Classify natural dye on the basis of sources</p> <p>7.4 List out the advantages and limitations of Natural Dyes</p> <p>7.5 Explain the extraction processes of Natural dyes</p> <p>7.6 Describe the dyeing procedure of cotton with Natural dye</p> | 3 | 5 |

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|----|--|----|----|
| 8 | Yarn Dyeing 8.1 Define yarn dyeing 8.2 State the purpose of yarn dyeing 8.3 State the merits and demerits of yarn dyeing 8.4 Classify yarn dyeing 8.5 Explain the preparatory process of yarn dyeing 8.6 Describe yarn dyeing sequence of cotton 8.7 Describe yarn dyeing sequence of polyester | 4 | 6 |
| 9 | Garments Dyeing 9.1 Define garments dyeing 9.2 State the purposes of garments dyeing 9.3 Describe the procedure of garments dyeing 9.4 State merits and demerits of garments dyeing 9.5 Describe the precautions of garments dyeing 9.6 Mention garments dyeing machineries 9.7 Describe the process of garments dyeing with Reactive dye | 4 | 6 |
| 10 | Procedure of Garments Dyeing 10.1 Describe the process of garments dyeing with pigment (Dirty wash/ Oil wash/CPD) 10.2 State the process of garments pigment dyeing with enzyme wash (General pigment dyeing procedure) 10.3 Describe over dyeing process of garments with direct dye 10.4 Describe the Dip dyeing process of garments 10.5 Discuss Tie dyeing process of garments | 4 | 7 |
| | Total | 32 | 60 |

Detailed Syllabus (Practical)

| Sl. | Experiment Name with procedure | Class (3 Period) | Continuous Marks |
|-----|--|---------------------|---------------------|
| 1 | <p>Perform the Application Procedure of Acid Dyes on Nylon Fabric</p> <p>1.1 Identify the fabric, relevant dyes, chemicals, auxiliaries & machineries</p> <p>1.2 Calculate the dyes & chemicals to obtain a required shade</p> <p>1.3 Perform the dyeing operation</p> <p>1.4 Maintain the record of performed experiment</p> | 1 | 2 |
| 2 | <p>Perform the Application Procedure of Basic dyes on Jute</p> <p>2.1 Identify the fabric, relevant dyes, chemicals, auxiliaries & machineries</p> <p>2.2 Calculate the dyes & chemicals to obtain a required shade</p> <p>2.3 Perform the dyeing operation</p> <p>2.4 Maintain the record of performed experiment</p> | 1 | 2 |
| 3 | <p>Perform the Application Procedure of Azoic dyes on Cotton fabric</p> <p>3.1 Identify the fabric, relevant dyes, chemicals, auxiliaries & machineries</p> <p>3.2 Calculate the dyes & chemicals to obtain a required shade</p> <p>3.3 Perform the dyeing operation</p> <p>3.4 Maintain the record of performed experiment</p> | 1 | 2 |
| 4 | <p>Perform the Application Procedure of Indigo dyes on Cotton (Rope Form)</p> <p>4.1 Identify the rope, relevant dyes, chemicals, auxiliaries & machineries</p> <p>4.2 Calculate the dyes & chemicals to obtain a required shade</p> <p>4.3 Perform the dyeing operation</p> <p>4.4 Maintain the record of performed experiment</p> | 1 | 2 |
| 5 | <p>Perform the Application Procedure of Pigment on Cotton fabric</p> <p>5.1 Identify the fabric, relevant pigment, chemicals, auxiliaries & machineries</p> <p>5.2 Calculate the pigment & chemicals to obtain a required shade</p> <p>5.3 Perform the dyeing operation</p> <p>5.4 Maintain the record of performed experiment</p> | 2 | 3 |

| | | | |
|----|--|---|---|
| 6 | <p>Perform the Application Procedure of Solvent dyes on Polyester fabric</p> <p>4.1 Identify the fabric, relevant dyes, chemicals, auxiliaries & machineries</p> <p>4.2 Calculate the dyes & chemicals to obtain a required shade</p> <p>4.3 Perform the dyeing operation</p> <p>4.4 Maintain the record of performed experiment</p> | 1 | 2 |
| 7 | <p>Perform the Application Procedure of Natural dyes on Cotton fabric</p> <p>7.1 Identify the fabric, relevant dyes, chemicals, auxiliaries & machineries</p> <p>7.2 Calculate the dyes & chemicals to obtain a required shade</p> <p>7.3 Perform the preparatory operation</p> <p>7.4 Perform the dyeing operation</p> <p>7.5 Maintain the record of performed experiment process</p> | 3 | 3 |
| 8 | <p>Perform the yarn dyeing sequence of Cotton</p> <p>8.1 Identify the yarn, relevant dyes, chemicals, auxiliaries & machineries</p> <p>8.2 Calculate the dyes & chemicals to obtain a required shade</p> <p>8.3 Perform the preparatory operation</p> <p>8.4 Perform the dyeing operation</p> <p>8.5 Maintain the record of performed experiment process</p> | 1 | 2 |
| 9 | <p>Perform the yarn dyeing sequence of Polyester</p> <p>9.1 Identify the yarn, relevant dyes, chemicals, auxiliaries & machineries</p> <p>9.2 Calculate the dyes & chemicals to obtain a required shade</p> <p>9.3 Perform the preparatory operation</p> <p>9.4 Perform the dyeing operation</p> <p>9.5 Maintain the record of performed experiment process</p> | 2 | 3 |
| 10 | <p>Perform the Garments dyeing procedure with Pigment (General Process)</p> <p>10.1 Identify the apparel, relevant dyes, chemicals, auxiliaries & machineries</p> <p>10.2 Calculate the dyes & chemicals to obtain a required shade</p> <p>10.3 Perform the preparatory operation</p> <p>10.4 Perform the dyeing operation</p> <p>10.5 Perform the post-treatment process</p> <p>10.6 Maintain the record of performed experiment</p> | 2 | 2 |

| | | | |
|----|--|-----------|-----------|
| 11 | Perform the Garments dyeing procedure with Reactive dye | 1 | 2 |
| | 11.1 Identify the apparel, relevant dyes, chemicals, auxiliaries & machineries | | |
| | 11.2 Calculate the dyes & chemicals to obtain a required shade | | |
| | 11.3 Perform the preparatory operation | | |
| | 11.4 Perform the dyeing operation | | |
| | 11.5 Perform the post-treatment process | | |
| | 11.6 Maintain the record of performed experiment | | |
| | Total | 16 | 25 |

Necessary Resources (Tools, Equipment and Machineries):

| Sl | Item Name | Quantity (piece/s) |
|----|--|--------------------|
| 1 | Fabric (Cotton, Jute, Nylon, Polyester) | As required |
| 2 | Yarn (Cotton, Polyester) | As required |
| 3 | Garment (Cotton made) | As required |
| 4 | Dye Stuff (Reactive, Acid, Basic, Azoic, Pigments, Solvent, Indigo and Natural dyes) | 1 kg each type |
| 5 | Pigments | 1 kg |
| 6 | Deionized Water | As required |
| 7 | Mordanting Agent | 1 kg |
| 8 | Alkali (Soda Ash, Caustic soda) | 10 kg each type |
| 9 | Acid (Acetic acid, Formic Acid, Green Acid) | 10 kg each type |
| 10 | Salt (Sodium Chloride, Glauber Salt) | 20 kg each type |
| 11 | Oxidizing Agent | 1 kg |
| 12 | Reducing Agent(Hydrose, Sodium Sulphide) | 5 kg |
| 13 | Wetting Agent | 5 kg |
| 14 | Sequestering Agent | 5 kg |
| 15 | Anti-migrating Agent | 5 kg |
| 16 | Softener | 5 kg |
| 17 | Detergent | 5 kg |
| 18 | Bleaching Agent | 5 kg |
| 19 | Sample Dyeing Machine | 2 set |
| 20 | Garments Dyeing Machine | 2 set |
| 21 | Tumble Dryer | 1 set |
| 22 | Infrared Dryer | 1 set |
| 23 | Sample Curing Machine | 2 set |
| 24 | Pipet, Conical Flask , Beaker, Funnel | 5 set |
| 25 | Digital Balance (Up to three digit) | 2 set |
| 26 | pH paper/meter | 2 set |
| 27 | Thermometer | 5 set |
| 28 | Stopwatch | 2 set |
| 29 | Burner | 5 set |

Recommended Books:

| Sl | Book Name | Writer Name | Publisher Name & Edition |
|----|--|-----------------------------|--------------------------|
| 01 | Technology of Textile Processing | DR. V. A. Shenai | Sevak publications |
| 02 | Textile Chemistry-I | MD. MoziburRahaman | ----- |
| 03 | Basic Principle of Textile Coloration | A D Broadbent | BMN-3 Foundation |
| 04 | Fundamentals and Practices in Coloration of Textiles | J N Chakraborty | ----- |
| 05 | Dyeing and Chemical Technology of Textile Fiber | E R Trotman | ----- |
| 06 | Dyeing Technology | Engr.MD. Abdul Kader Bepari | ----- |
| 07 | Technology of Bleaching and Dyeing of Textile Fibers | Chakrawarthy | Coxtown Publication |
| 08 | Textile Dyes | N. N. Mahapatra | ----- |

Website References:

| Sl | Web Link | Remarks |
|----|---|---------|
| 01 | https://nptel.ac.in/ | |
| 02 | https://textilelearner.net/ | |
| 03 | https://fiber2fashion.com/ | |
| 04 | https://textilestudycenter.com/ | |
| 05 | https://onlinegarmentsacademy.blogspot.com/ | |
| 06 | https://textilefashionstudy.com/ | |
| 07 | https://textiletuts.com/ | |

Rupak Kanti Bishwas
System Analyst
Bangladesh Technical Educational Board

Md. Rashedul Islam
Executive Director
APS Group, Gazipur

Md. Hatem Ali
Ex-General Manager
Unique Washing & Dyeing, Dhaka

Md. Ariful Islam
Instructor
Daffodil Technical Institute, Dhaka

Kazi Sirajul Islam
Lecturer
Bangladesh University of Textiles

Engr. Md. Abdul Kader Bepari
Principal
Shahid Abdur Rab Serniabat
Textile Engineering College,
Barishal

Validated By

Rupak Kanti Bishwas
System Analyst
Bangladesh Technical Educational Board

Md. Ariful Islam
Instructor
Daffodil Technical Institute, Dhaka

Mahmudul Hasan
Principal
Sunamganj Textile Institute,
Sunamganj

| Subject Code | Subject Name | Period/Week | | Credit |
|--------------|------------------|-------------|---|--------|
| 21363 | Textile Printing | T | P | C |
| | | 2 | 3 | 3 |

| | |
|-------------------------------------|--|
| Rationale | <p>Students need to gather knowledge about design of textile printing for time-saving, cost minimization, perfect design development in textile materials. By studying this subject, the diploma in textile engineering students will be able to learn technological advancement of Industrial Revolution 4.0 which is the current trend of automation and data exchange in textile printing technologies. By learning various types of machineries and methods for printing the students will know how to print the textile materials, design development and evaluation of the printing performances. After successful completion of this course they will be able to apply their knowledge and skill at professional career that will enhance professional career as well as develop apparel sector in Bangladesh. At the same time it will help to earn foreign currency that will advance our nation to a developing country very soon.</p> |
| Learning Outcome (Theory) | <p>After successful completion of this course, students will be able to:</p> <ol style="list-style-type: none"> 1. Develop various textile printing designs 2. Describe screen preparation 3. Explain textile printing ingredients and functions 4. Describe the use of printing paste on the textile materials 5. Interpret the dye-fiber interaction through the steaming, curing and washing processes 6. Clarify the quality of the printed products 7. Mention the problems of printed products with remedies |
| Learning Outcome (Practical) | <p>After undergoing the subject, students will be able to:</p> <ul style="list-style-type: none"> ○ Prepare printing paste ○ Identify machineries involved in printing ○ Operate textile printing machineries ○ Develop essential design for screen ○ Point out the ingredients for printing paste ○ Calculate printing recipe as well as shade percentage by using spectrophotometer ○ Perform process sequence for textile printing ○ Demonstrate textile printing processing machinery and their operations |

Detailed Syllabus (Theory)

| SL No | Topics with Contents | Class (1 period) | Final Marks |
|-------|--|------------------|-------------|
| 1 | <p>Design development for textile printing</p> <p>1.1 Define design for textile printing 1.2 Mention the types of design 1.3 List out the sources of design 1.4 Mention the uses of Illustrator for printing design 1.5 Mention the uses of Adobe Photoshop for printing design 1.6 Describe the repeat of design and repeat alignment 1.7 State the limitations of repeat size in design.</p> | 3 | 6 |
| 2 | <p>Screen preparation for fabric printing</p> <p>2.1 Define screen for textile printing 2.2 Classify screen 2.3 Mention the chemicals required for screen preparation 2.4 Mention the sequence of screen preparation 2.5 List out the light sources for screen preparation 2.6 Describe the squeeze system</p> | 4 | 6 |
| 3 | <p>Printing paste preparation</p> <p>3.1 Define printing paste 3.2 Define water-based and oil-based printing paste 3.3 Define printing thickener 3.4 Classify printing thickener 3.5 State the suitability of thickener for different dyes and fibers 3.6 Discuss the functions of ingredients used in reactive printing on cotton 3.7 Discuss the functions of ingredients used in disperse printing on polyester 3.8 Illustrate the functions of ingredients used in pigment printing on cotton and polyester</p> | 4 | 7 |
| 4 | <p>Textile printing procedure</p> <p>4.1 State the common process flow chart of textile printing procedure 4.2 Discuss the printing process of cellulosic fabric by reactive dye 4.3 Describe the printing process of polyester fabric by disperse dye 4.4 Discuss the printing process of cellulosic fabric by pigment 4.5 Describe the printing process of polyester fabric by pigment 4.6 Discuss the printing process of wool and silk fabric by pigment 4.7 State the advantages and disadvantages of pigment printing 4.8 State the advantages and disadvantages of disperse printing 4.9 State the advantages and disadvantages of reactive printing</p> | 4 | 10 |
| 5 | <p>Machinery of textile printing</p> <p>5.1 Mention the general machineries used for textile printing</p> | 4 | 6 |

| | | | |
|----|---|----|----|
| | <p>5.2 Describe the uses of flatbed screen printing machine for textiles</p> <p>5.3 Mention the uses of rotary screen printing machine for textiles</p> <p>5.4 Differentiate between flatbed and rotary screen printing machine</p> <p>5.5 Point out the main parts of flatbed and rotary screen printing machine</p> | | |
| 6 | <p>Drying systems</p> <p>6.1 Describe the drying methods for printing</p> <p>6.2 State the various drying system after printing</p> <p>6.3 Mention the factors considered for selection of dryer</p> <p>6.4 Mention the different types of dryer machine used in textile printing industry</p> | 3 | 5 |
| 7 | <p>Steaming and Curing</p> <p>7.1 Define steaming</p> <p>7.2 Define Curing</p> <p>7.3 Differentiate between steaming and curing</p> <p>7.4 Discuss the importance of steaming and curing in printing</p> <p>7.5 State the principle of steaming and curing machine during printing</p> | 2 | 4 |
| 8 | <p>Washing for Textile Printing</p> <p>8.1 Define washing for textile printing</p> <p>8.2 State the purpose of washing after textile printing</p> <p>8.3 Describe the various washing processes after textile printing</p> | 2 | 4 |
| 9 | <p>Testing in printed goods</p> <p>9.1 Mention the necessity of testing in printed goods</p> <p>9.2 State the required testing in printed goods</p> <p>9.3 Describe color fastness to wash, rubbing, light, perspiration and hot pressing</p> <p>9.4 Describe color bleeding performance</p> <p>9.5 List out the chemical test for toxic materials and carcinogenic contents</p> | 3 | 6 |
| 10 | <p>Faults and Remedies for Textile Printing</p> <p>10.1 Discuss the faults and remedies of screen preparation</p> <p>10.2 Describe the faults and solutions during textile printing process</p> <p>10.3 State the limitations of textile printing process</p> | 3 | 6 |
| | Total | 32 | 60 |

Detailed Syllabus (Practical)

| SL No | Experiment names with procedure | Class (3 Period) | Continuous Marks |
|-------|--|------------------|------------------|
| 1 | Develop various designs for textile printing 1.1 Collect design from buyers 1.2 Develop design using different software as per buyer requirement 1.3 Maintain the record of performed experiment | 1 | 2.5 |
| 2 | Prepare Screen for fabric printing 2.1 Choose the mesh fabric 2.2 Attach the mesh fabric with appropriate frame 2.3 Collect necessary chemicals 2.4 Apply chemicals on the mesh fabric 2.5 Maintain proper light sources to obtain an appropriate design 2.5 Maintain the record of performed experiment | 1 | 2.5 |
| 3 | Prepare printing paste for textile fabric printing .1 Select ingredients for making textile printing paste 3.2 Perform necessary calculations to obtain a required shade 3.3 Apply chemicals and auxiliaries for making textile printing paste 3.4 Prepare the textile printing paste 3.5 Maintain the record of the experiment. | 1 | 2.5 |
| 4 | Perform operation of flatbed screen printing machine 4.1 Sketch and identify different components of flatbed printing machine 4.2 Demonstrate the operation of flatbed printing machine 4.3 Observe the effect of required print on printed fabrics 4.4 Maintain the record of performed experiment | 1 | 2.5 |
| 5 | Perform operation of rotary screen printing machine 5.1 Sketch and identify different components of rotary printing machine 5.2 Demonstrate the operation of rotary printing machine 5.3 Observe the effect of required print on printed fabrics 5.4 Maintain the record of performed experiment | 1 | 2.5 |

| | | | |
|----|---|-----------|------------|
| 6 | <p>Perform printing with pigment on cellulosic materials</p> <p>6.1 Collect pigment, necessary chemicals and fabrics</p> <p>6.2 Perform necessary calculations to obtain a required shade</p> <p>6.3 Apply chemicals and auxiliaries for printing of cellulosic fabrics</p> <p>6.4 Demonstrate the printing process with pigment on cellulosic fabric</p> <p>6.5 Maintain the record of performed experiment</p> | 1 | 2.5 |
| 7 | <p>Perform printing of reactive dyes on cellulosic materials</p> <p>7.1 Collect reactive dye, necessary chemicals and fabrics</p> <p>7.2 Perform necessary calculations to obtain a required shade</p> <p>7.3 Apply chemicals and auxiliaries for printing of printing of cellulosic fabrics</p> <p>7.4 Demonstrate the printing process with reactive dye on cellulosic fabric</p> <p>7.5 Maintain the record of performed experiment</p> | 1 | 2.5 |
| 8 | <p>Perform application of disperse dyes on polyester fabrics</p> <p>8.1 Collect disperse dye, necessary chemicals and fabrics</p> <p>8.2 Perform necessary calculations to obtain a required shade</p> <p>8.3 Apply chemicals and auxiliaries for printing of polyester fabrics</p> <p>8.4 Demonstrate the printing process with disperse dye on polyester fabric</p> <p>8.5 Maintain the record of performed experiment</p> | 1 | 2.5 |
| 9 | <p>Demonstrate drying, steaming and curing machinery in textile printing process</p> <p>9.1 Sketch and identify different components of drying, steaming and curing machine</p> <p>9.2 Demonstrate the operation of drying, steaming and curing machine</p> <p>9.3 Maintain the record of performed experiment</p> | 1 | 2.5 |
| 10 | <p>Demonstrate the faults and remedies of textile printing</p> <p>10.1 Collect faulty samples from printing industries</p> <p>10.2 Identify the name of faults and find their possible remedies</p> <p>10.3 Maintain the record of performed experiment</p> | 1 | 2.5 |
| | Total | 10 | 2.5 |

Necessary Resources (Tools, equipment and Machinery):

| Sl | Item Name | Quantity (piece/s) |
|----|---|--------------------|
| 01 | Cotton fabric | 05 yds |
| 02 | Polyester fabric | 05 yds |
| 03 | Wool | 05 yds |
| 04 | Silk | 05 yds |
| 05 | Pigment | 01 kg |
| 06 | Reactive dye | 01 kg |
| 07 | Disperse dye | 01 kg |
| 08 | Chemicals and auxiliaries | 10 kg |
| 09 | Screen printing accessories | 10 pcs |
| 10 | Computer | 1 pc |
| 11 | Sample flatbed printing machine | 1 pc |
| 12 | Sample rotary printing machine | 1 pc |
| 13 | Screen preparation chemicals | 1pc |
| 14 | Drying, curing and steaming Machine | 1 pc |
| 15 | Measuring cylinder, Pipette, Conical Flask and Beaker | 10 pcs |
| 16 | p ^H Meter | 05 pcs |
| 17 | Thermometer | 05 pcs |
| 18 | Hand Iron | 2 pcs |
| 19 | Hand Scissors | 10 pcs |
| 20 | Screen printing table | 01 pcs |
| 21 | Digital balance | 01 pc |

Recommended Books:

| SL | Book Name | Writer Name | Publisher Name & Edition |
|----|------------------------|------------------|---|
| 01 | Technology of Printing | Dr. V A Shenai | 5 th edition, Sevak Publications |
| 02 | Textile Printing | Leslie W C Miles | 2 nd edition, Bradford |

Website References:

| SL | Web Link | Remarks |
|----|---|---------|
| 01 | https://www.youtube.com | |
| 02 | https://nptel.ac.in/course | |
| 03 | https://textilestudycenter.com | |

Eng. Shib Shankar Chakraborty
Principle (Retd.)
Department of Textiles, Ministry of
Textiles and Jute

Muhammad Abdur Rashid
Assistant Professor
Department of Textile Engineering
DUET, Gazipur

Md. Saifur Rahman
Deputy Director
Department of Textiles, Dhaka

Md. Hatem Ali
Ex. GM
Unique Washing and Dyeing Ltd,
Dhaka

Md. Imdadul Haque
DGM
Argon Denim Ltd,
Gazipur

Rupok Kanti Bishash
System Analyst
Bangladesh Technical Education
Board

Validated by:

Tamim Dewan
Junior Instructor
Textile Institute, Khulna

Dr. Muhammad Abdur Rashid
Associate Professor
Department of Textile Engineering
DUET, Gazipur

| Subject Code | Subject Name | Period per Week | | Credit |
|--------------|-------------------|-----------------|---|--------|
| 21364 | Textile Finishing | T | P | C |
| | | 2 | 3 | 3 |

| | |
|---------------------------------------|--|
| Rationale | <p>This course is designed to enrich students with the knowledge of different textile Finishing processes, chemicals, auxiliaries and machineries used in the field of Textile Finishing. Textile Finishing is very important sector considering the aesthetic and functional finishes to meet the requirement of buyers. Yarns, knitted and woven fabric needs some of mandatory mechanical and chemical finishes for consumer satisfaction. To increase the market demand and attraction of textile goods, finishing is getting widespread for textile factories day by day. That's why, various mechanical and chemical finishing process of yarn, fabric and garments are included in this course.</p> |
| Learning Outcome (Theoretical) | <p>After completing the course, students will be able to:</p> <ol style="list-style-type: none"> 1. Illustrate different mechanical and chemical finishing processing 2. Interpret the process sequence of textile finishing process. 3. Illustrate different textile finishing machines 4. State different functional finishing chemicals and compatible auxiliaries for various textiles process 5. Explain working Procedure of various textile finishing machines 6. Describe Controlling parameters of various textile finishing machines 7. State the necessity of special finishing process |
| Learning Outcome (Practical) | <p>After completing the course, students will be able to:</p> <ol style="list-style-type: none"> 1. Identify different finishing chemicals and auxiliaries 2. Identify the process sequence and passage diagram for particular finishing machine 3. Recognize changes brought about after finishing 4. Calculate the amount relevant finishing agent, chemicals and auxiliaries to carry out efficient finishing operation 5. Point out the different parts of finishing machines |

Detailed Syllabus (Theory)

| Unit | Topics with Contents | Class (3 Period) | Final Marks |
|------|---|------------------|-------------|
| 1 | Textile Finishing 1.8 Define Textile Finishing 1.9 State the significance of Textile Finishing 1.10 Classify textile finishing 1.11 Describe the types of Mechanical & Chemical finishing 1.12 Distinguish between aesthetic & functional finishes | 2 | 4 |
| 2 | Dyed Yarn Finishing 2.8 State the significance of dyed yarn finishing 2.9 Mention the objectives of Hydro extraction, Drying & Hard winding 2.10 Describe the working procedure & controlling parameters of Hydro extractor machine 2.11 Discuss the working procedure & controlling parameters of RF Dryer & steam Dryer. 2.12 Explain the working procedure & controlling parameters of hard winding machine. | 3 | 6 |
| 3 | Mercerization & Calendaring 3.1 Define Mercerization 3.2 Mention the objective of mercerization 3.3 Define Tension, Slack & Ammonia Mercerization 3.4 Distinguish between cold & hot mercerization. 3.5 Describe the physical & chemical changes caused by mercerization 3.6 Discuss the factors to be considered for mercerization 3.7 Describe the working procedure of mercerization process 3.8 Define Calendaring process 3.9 Point out the objective of Calendaring process 3.10 Describe the types of Calendaring process | 3 | 6 |
| 4 | Sanforizing 4.1 Define Sanforizing 4.2 State the importance of Sanforizing 4.3 Describe the working procedure of sanforizing machine 4.4 Discuss the controlling parameters of Sanforizing process 4.5 Mention the advantages of Sanforizing. | 2 | 4 |

| | | | |
|---|---|---|---|
| 5 | <p>Knit fabric finishing in Tube line</p> <p>5.1 Define Squeezing, Drying and Tube Compacting</p> <p>5.2 Mention the objectives of Squeezing, Drying and Compacting</p> <p>5.3 Describe the working procedure and controlling parameters of Squeezer Machine</p> <p>5.4 Discuss the working procedure and controlling parameters of Drying Machine</p> <p>5.5 Illustrate the working procedure and controlling parameters of tube compacting Machine</p> | 4 | 8 |
| 6 | <p>Knit fabric finishing in open line</p> <p>6.1 Define slitting & dewatering</p> <p>6.2 Define open compacting</p> <p>6.3 Mention the objectives of slitting & dewatering and open compacting</p> <p>6.4 Describe the working procedure and controlling parameters of slitting and dewatering machine.</p> <p>6.5 Discuss the working procedure and controlling parameters of open compacting.</p> <p>6.6 Explain GSM, shrinkage and diameter control by open compactor</p> | 4 | 8 |
| 7 | <p>Stentering</p> <p>7.1 Define Stentering</p> <p>7.2 Define curing, drying, steaming and heat setting</p> <p>7.3 Mention the objectives of Stentering</p> <p>7.4 Explain working principle and procedure of stenter</p> <p>7.5 Discuss the drying parameters of stenter</p> <p>7.6 Describe the heat setting parameters of stenter</p> <p>7.7 Describe the curing parameters of stenter</p> <p>7.8 Explain bias, bowing and skewness controlling process by stenter</p> <p>7.9 Mention the utilities required for stenter</p> | 3 | 6 |
| 8 | <p>Functional Finish</p> <p>8.1 Define Functional finish</p> <p>8.2 List the objectives of functional finish</p> <p>8.3 Define wrinkle free, water repellent, soil release and anti-microbial finish</p> <p>8.4 Define fire retardant, GSM improver, anti- static finish and resin finish</p> <p>8.5 Explain the working mechanism of wrinkle free resin finish and fire-retardant finishing chemicals</p> <p>8.6 Distinguish between mechanical and functional finish</p> <p>8.7 Define Plasma Finish</p> | 3 | 6 |

| | | | |
|----|---|-----------|-----------|
| 9 | Softener and brightener 9.1 Define softener and brightener 9.2 Mention the purposes of softening and brightening 9.3 State the necessity of softening 9.4 Describe the various type of softener 9.5 Discuss the type of optical brightening agent 9.6 Explain softener selection for textile finish | 4 | 6 |
| 10 | Special mechanical finishing 10.1 Define brushing/raising, shearing, sueding/peach finish and embossing, 10.2 Mention the objectives of brushing/raising, shearing, sueding/peach/carbon finish and embossing 10.3 Describe working procedure and controlling parameters of brushing/raising machine 10.4 Explain working procedure and controlling parameters of sueding machine 10.5 Explain working procedure and controlling parameters of Shearing machine | 4 | 6 |
| | Total | 32 | 60 |

Detailed Syllabus (Practical)

| Sl. No | Experiment Name with procedure | Class (3 Period) | Continuous Marks |
|--------|--|------------------|------------------|
| 1 | <p>Demonstrate Hydro extractor and dewatering machine for water removal</p> <p>1.5 Sketch the passage diagram of dewatering machine.</p> <p>1.6 Identify different parts of Hydro extractor and dewatering machine</p> <p>1.7 Perform calculation of water extraction percentage</p> <p>1.8 Maintain the record of performed experiment</p> | 2 | 2.5 |
| 2 | <p>Demonstrate of tumble dryer, RF dryer and drying machine</p> <p>2.1 Sketch the passage diagram of RF dryer and drying machine</p> <p>2.2 Identify different parts of tumble dryer, RF dryer and drying machine</p> <p>2.3 Perform calculation of moisture content to asses drying performance</p> <p>2.4 Maintain the record of performed experiment</p> | 2 | 2.5 |
| 3 | <p>Demonstrate Mercerizing and Calendaring Machine</p> <p>3.1 Sketch the passage diagram of Mercerizing and Calendaring Machine</p> <p>3.2 Perform slack mercerization of cotton sample by open bath process</p> <p>3.3 Identify different parts of mercerizing and calendaring machine</p> <p>3.4 Perform assessment of NaOH concentration by Twaddell scale/ Baumé scale</p> <p>3.5 Prepare estimate of the mercerization efficiency by Barium Activity Number (BAN)</p> <p>3.6 Maintain the record of performed experiment</p> | 2 | 2.5 |

| | | | |
|---|--|---|-----|
| 4 | <p>Demonstrate Sanforizing and Compacting machine</p> <p>4.1 Sketch the passage diagram of Sanforizing and Compacting machine</p> <p>4.2 Identify different parts of Sanforizing and Compacting machine</p> <p>4.3 Observe changes occurred after sanforizing and compacting</p> <p>4.4 Maintain the record of performed experiment</p> | 2 | 2.5 |
| 5 | <p>Demonstrate the Stenter Machine</p> <p>5.1 Sketch the passage diagram of stenter machine</p> <p>5.2 Identify different parts of stenter machine</p> <p>5.3 Observe chemical finishes application process in padder of stenter</p> <p>5.4 Maintain the record of performed experiment</p> | 2 | 2.5 |
| 6 | <p>Demonstrate Brushing/Raising Machine and Sueding Machine</p> <p>6.1 Sketch the passage diagram of Brushing and Sueding machine</p> <p>6.2 Identify different parts of Brushing and Sueding machine</p> <p>6.3 Perform necessary calculation to obtain a required shade</p> <p>6.4 Observe changes occurred after Brushing and Sueding</p> <p>6.5 Maintain the record of performed experiment</p> | 2 | 2.5 |
| 7 | <p>Perform application of Softeners</p> <p>7.1 Perform necessary calculation as per recipe</p> <p>7.2 Perform necessary preparatory process</p> <p>7.3 Apply chemicals and auxiliaries for softening process</p> <p>7.4 Observe changes occurred after softening</p> <p>7.5 Maintain the record of performed experiment</p> | 1 | 2.5 |

| | | | |
|----|--|----|-----|
| 8 | <p>Perform application of Wrinkle free Finish</p> <p>8.1 Perform necessary calculation as per recipe</p> <p>8.2 Perform necessary preparatory process</p> <p>8.3 Apply chemicals and auxiliaries for wrinkle free finishing</p> <p>8.4 Observe changes occurred after application of Wrinkle free Finish</p> <p>8.5 Maintain the record of performed experiment</p> | 1 | 2.5 |
| 9 | <p>Perform application of Brightener</p> <p>9.1 Perform necessary calculation as per recipe</p> <p>9.2 Perform necessary preparatory process</p> <p>9.3 Apply chemicals and auxiliaries for brightening</p> <p>9.4 Observe changes occurred after application of Brightener</p> <p>9.5 Maintain the record of performed experiment</p> | 1 | 2.5 |
| 10 | <p>Perform application of Resin Finish</p> <p>10.1 Perform necessary calculation as per recipe</p> <p>10.2 Perform necessary preparatory process</p> <p>10.3 Apply chemicals and auxiliaries for resin finish</p> <p>10.4 Observe changes occurred after application of resin finish</p> <p>10.5 Maintain the record of performed experiment</p> | 1 | 2.5 |
| | Total | 16 | 25 |

Necessary Resources (Tools, Equipment and Machinery):

| Sl | Item Name | Quantity (piece/s) |
|----|---|--------------------|
| 01 | Cotton Fabric | As Required |
| 02 | Blended Fabric (PC, CVC) | As Required |
| 03 | 100% Polyester Fabric | As Required |
| 04 | Lycra Blended Cotton Fabric | As Required |
| 05 | Lycra Blended Polyester Fabric | As Required |
| 06 | Alkali (Soda Ash, Caustic soda) | As Required |
| 07 | Acid (Acetic acid, Formic Acid, Green Acid) | As Required |
| 08 | Wetting Agent | As Required |
| 09 | Sequestering Agent | As Required |
| 10 | Detergent | As Required |
| 11 | Softener | As Required |
| 12 | Brightener | As Required |
| 12 | GSM improver | As Required |

| | | |
|----|--------------------------------------|-------------|
| 13 | Wrinkle free finish | As Required |
| 14 | Pipet, Conical flask, beaker, Funnel | As Required |
| 15 | Digital balance (up to three digit) | 1 set |
| 16 | pH paper/ meter | 1 set |
| 17 | Thermometer | 1 set |
| 18 | Stopwatch | 1 set |
| 19 | Tumble dryer | 1 set |
| 20 | Mercerizing machine | 1 |
| 21 | Calendaring machine | 1 |
| 22 | Sanforizing machine | 1 |
| 23 | Hydro extractor | 1 |
| 24 | RF Dryer | 1 |
| 25 | Slitting and Dewatering Machine | 1 |
| 26 | Dryer | 1 |
| 27 | Stenter | 1 |
| 28 | Open Compactor | 1 |
| 29 | Tube Comapctor | 1 |
| 30 | Brushing/Raising machine | 1 |
| 31 | Sueding machine | 1 |
| | | |

Recommended Books:

| SI | Book Name | Writer Name | Publisher Name & Edition |
|----|--|------------------------------|---|
| 01 | Basic Principles of Textile Coloration | Arthur D Broadbent | Society of dyers and colourists |
| 02 | Textile Finishing | Edited by Derek Heywood | - |
| 03 | Principles of Textile Finishing | Asim Kumar Roy choudhury | Elsevier Science |
| 04 | Textile Finishing Chemicals: An Industrial Guide | Ernest W. Flick | Noyes Publications |
| 05 | Chemistry & Technology of Fabric Preparation & Finishing | By Dr. Charles Tomasino | North Carolina State University |
| 06 | Chemical Finishing of Textiles | W D Schindler and P J Hauser | Woodhead Publishing Series in Textiles Book |
| 07 | টেক্সটাইল ফিনিশিং | শাহজাহান ফিরোজ | - |

Website References:

| Sl | Web Link | Remarks |
|----|---|---|
| 01 | https://www.youtube.com/watch?v=DeEN-eytpeA | Mercerizing & Heat-setting |
| 02 | https://www.youtube.com/watch?v=rxMHvulEmBE | Mercerizing Machine |
| 03 | https://www.youtube.com/watch?v=Gu5FDVwFWk8 | Stenter Machine |
| 04 | https://www.youtube.com/watch?v=INEwDMTnlWI | Shinner calendering machine |
| 05 | https://www.youtube.com/watch?v=EfbFGU-OrcA | 5 Roller Calendar machine |
| 06 | https://www.youtube.com/watch?v=b9qPccCaOXU | Sanforization Process |
| 07 | https://www.youtube.com/watch?v=-BhzP-0Mha0&t=81s | Different Types of Textile Finishing Process: Peach Finishing, Sanforizing and Stentering Process |
| 08 | https://fiber2fashion.com/ | |
| 09 | https://textilestudycenter.com/ | |
| 10 | https://onlinegarmentsacademy.blogspot.com/ | |
| 11 | https://textilefashionstudy.com/ | |
| 12 | Online Publications | |

Md. Atiqur Rahman Prodhan
Principal
Dinajpur Textile Institute

Md. Golam Nur
Chief Instructor
Natore Textile Institute

Md. Abu Hanif
Junior Instructor
Chattogram Textile Institute

Engr. Arifur Rahman
Deputy General Manger
Fiha Textile Limited, Gazipur

Engr. Shamim Rahman
Director
South East Composite Ltd, Tangail

MD. Rezvi Hossain
Assistant Programmer
Bangladesh Technical Education
Board, Dhaka

Validated by

Engr. Md. Abu Sayed
Junior Instructor
Natore Textile Institute,
Natore

Engr. Salma Akter
Attached Officer
Bangladesh Technical Education
Board, Dhaka

Engr. Md. Atiqur Rahman Prodhan
Principal
Dinajpur Textile Institute, Dinajpur

| Subject Code | Subject Name | Period Per Week | | Credit |
|--------------|--|-----------------|---|--------|
| 21365 | APPLICATION OF COMPUTER IN TEXTILE WET PROCESSING | T | P | C |
| | | 0 | 6 | 2 |

| | |
|-------------------------------------|---|
| Rationale | <p>Students need to gather computer-based technology in the wet processing industry for high-quality dyed fiber, yarn and fabric production, critical dyeing, printing, finishing, time-saving, cost minimization and Research & Development. By studying this subject, the diploma in textile engineering students will be able to learn technological advancement of Industrial Revolution 4.0 which is the current trend of automation and data exchange in wet processing technologies. By learning various types of software used for wet processing machinery, the students will know how to prepare recipes, shade prediction & matching, 3-D printing, advanced finishing, critical dyeing, quality control of robotic testing lab and production management, quality prediction, database management system. Upon successful completion of this course they will be able to apply fruitfully at professional career.</p> |
| Learning Outcome (Practical) | <p>After successful completion of this course, students will be able to:</p> <ol style="list-style-type: none"> 1. Install different production and quality control related software and hardware 2. Operate machine integrated software of wet processing machinery 3. Apply different tools and software to make the production process efficient and effective assuring better product quality in various stages such as pre-treatment, dyeing, printing, finishing and washing 4. Maintain software for monitoring and environmental controlling 5. Analyze the parameters based on buyer demand and solving problems during manufacturing 6. Perform data management in wet processing production floor and laboratory |

Detailed Syllabus (Practical)

| SL | Experiments name with procedure | Class (3 Period) | Continuous Marks |
|----|---|------------------|------------------|
| 1 | <p>Observe hardware and software for wet processing machinery</p> <p>1.8 Identify different software used in wet processing machinery</p> <p>1.9 List out input, output and storage devices used in wet processing machinery</p> <p>1.10 Install software and hardware components related to wet processing</p> <p>1.11 Maintain the record of the performed experiment.</p> | 2 | 2 |
| 2 | <p>Perform the computer-based job responsibilities as a production or quality control officer</p> <p>2.7 Identify computer-based job responsibilities of production or quality control officer</p> <p>2.8 Mention different machine's monitor or display</p> <p>2.9 Observe testing instrument, Pre-treatment, Dyeing machine, Printing and Finishing machine software</p> <p>2.10 Operate basic wet processing software</p> <p>2.11 Maintain the record of the performed experiment</p> | 1 | 2 |
| 3 | <p>Demonstrate computerized spectrophotometer machine</p> <p>3.1 Observe different brand and model of spectrophotometer machine</p> <p>3.2 Identify different operations of spectrophotometer machine</p> <p>3.3 Adjust different settings of spectrophotometer machine</p> <p>3.4 Perform production data operations, quality data operations and electro-mechanical data operations of spectrophotometer machine</p> <p>3.5 Maintain the record of the performed experiment</p> | 3 | 3 |
| 4 | <p>Demonstrate computerized pre-treatment machinery</p> <p>4.1 Observe different pretreatment machinery</p> <p>4.2 Identify different operations of pre-treatment machinery</p> <p>4.3 Adjust different settings of pre-treatment machinery</p> <p>4.4 Perform production data operations, quality data operations and electro-mechanical data operations of pre-treatment machinery</p> <p>4.5 Maintain the record of the performed experiment</p> | 2 | 3 |

| | | | |
|---|--|---|---|
| 5 | <p>Perform operations on computer-controlled fiber dyeing machinery</p> <p>5.1 Observe different fiber dyeing machinery</p> <p>5.2 Identify different operations of fiber dyeing machinery</p> <p>5.3 Adjust different settings of fiber dyeing machinery</p> <p>5.4 Perform production data operations, quality data operations and electro-mechanical data operations of fiber dyeing machinery</p> <p>5.5 Maintain the record of the performed experiment.</p> | 1 | 2 |
| 6 | <p>Demonstrate computerized yarn dyeing machinery</p> <p>6.1 Observe different yarn dyeing machinery</p> <p>6.2 Identify different operations of yarn dyeing machinery</p> <p>6.3 Adjust different settings of yarn dyeing machinery</p> <p>6.4 Perform production data operations, quality data operations and electro-mechanical data operations of yarn dyeing machinery</p> <p>6.5 Maintain the record of the performed experiment.</p> | 1 | 3 |
| 7 | <p>Demonstrate computer-controlled woven fabric dyeing machinery</p> <p>7.6 Observe different woven fabric dyeing machinery</p> <p>7.7 Identify different operations of woven fabric dyeing machinery</p> <p>7.8 Adjust different settings of woven fabric dyeing machinery</p> <p>7.9 Perform production data operations, quality data operations and electro-mechanical data operations of woven fabric dyeing machinery</p> <p>7.10 Maintain the record of the performed experiment.</p> | 2 | 3 |
| 8 | <p>Demonstrate Computerized knit fabric dyeing machinery</p> <p>8.1 Observe different knit fabric dyeing machinery</p> <p>8.2 Identify different operations of knit fabric dyeing machinery</p> <p>8.3 Adjust different settings of knit fabric dyeing machinery</p> <p>8.4 Perform production data operations, quality data operations and electro-mechanical data operations of knit fabric dyeing machinery</p> <p>8.5 Maintain the record of the performed experiment.</p> | 2 | 3 |
| 9 | <p>Perform the Operation on Computerized screen-printing machinery</p> <p>10.1 Observe different automatic screen machinery</p> <p>10.2 Identify different functions of automatic screen machinery</p> | 2 | 3 |

| | | | |
|----|---|---|---|
| | <p>10.3 Adjust different settings of automatic screen machinery</p> <p>10.4 Perform production data operations, quality data operations and electro-mechanical data operations of automatic screen machinery</p> <p>10.5 Maintain the record of the performed experiment.</p> | | |
| 10 | <p>Demonstrate Computerized allover printing machinery</p> <p>11.1 Observe different allover printing machinery</p> <p>11.2 Identify operations of allover printing machinery</p> <p>11.3 Adjust different settings of allover printing machinery</p> <p>11.4 Perform production data operations, quality data operations and electro-mechanical data operations of allover printing machinery</p> <p>11.5 Maintain the record of the performed experiment.</p> | 2 | 3 |
| 11 | <p>Demonstrate computer-controlled fabric dewatering, dryer & compactor machinery</p> <p>12.1 Observe different fabric dewatering, dryer & compactor machinery</p> <p>12.2 Identify different operations of fabric dewatering, dryer & compactor machinery</p> <p>12.3 Adjust different settings of fabric dewatering, dryer & compactor machinery</p> <p>12.4 Perform production data operations, quality data operations and electro-mechanical data operations of fabric dewatering, dryer & compactor machinery</p> <p>12.5 Maintain the record of the performed experiment.</p> | 3 | 3 |
| 12 | <p>Perform operations of computer-controlled mercerizing machine</p> <p>13.1 Observe different mercerizing machine</p> <p>13.2 Identify different operations of mercerizing machine</p> <p>13.3 Adjust different settings of mercerizing machine</p> <p>13.4 Perform production data operations, quality data operations and electro-mechanical data operations of mercerizing machine</p> <p>13.5 Maintain the record of the performed experiment.</p> | 1 | 2 |
| 13 | <p>Demonstrate computerized stenter & sanforizing machine</p> <p>14.1 Observe different stenter & sanforizing machine</p> <p>14.2 Identify different operations of stenter & sanforizing machine</p> <p>14.3 Adjust different settings of stenter & sanforizing machine</p> | 2 | 3 |

| | | | |
|----|---|---|---|
| | <p>14.4 Perform production data operations, quality data operations and electro-mechanical data operations of stenter & sanforizing machine</p> <p>14.5 Maintain the record of the performed experiment.</p> | | |
| 14 | <p>Demonstrate Computerized washing machinery</p> <p>14.1 Observe different washing machinery</p> <p>14.2 Identify different operations of washing machinery</p> <p>14.3 Adjust different settings of washing machinery</p> <p>14.4 Perform production data operations, quality data operations and electro-mechanical data operations of washing machinery</p> <p>14.5 Maintain the record of the performed experiment.</p> | 1 | 2 |
| 15 | <p>Conduct laboratory environment controlling software</p> <p>15.1 Set appropriate relative humidity and temperature</p> <p>15.2 Maintain appropriate RH and temperature in different sections</p> <p>15.3 Record daily RH and temperature data</p> <p>15.4 Maintain the record of the performed experiment.</p> | 1 | 2 |
| 16 | <p>Perform daily inventory report by ERP software</p> <p>16.1 Identify the tools of ERP Software</p> <p>16.2 Identify the function of ERP Software</p> <p>16.3 Prepare daily inventory report</p> <p>16.4 Record the inventory report for further uses</p> <p>16.5 Modify the inventory report for analysis</p> <p>16.6 Maintain the record of the performed experiment.</p> | 1 | 2 |
| 17 | <p>Perform daily production report by ERP software</p> <p>17.1 Prepare daily production report</p> <p>17.2 Record the report for further uses</p> <p>17.3 Modify the production report for analysis</p> <p>17.4 Maintain the record of the performed experiment.</p> | 1 | 2 |
| 18 | <p>Perform daily quality report by ERP software</p> <p>18.1 Prepare daily quality report</p> <p>18.2 Record the report for further uses</p> <p>18.3 Modify the quality report for analysis</p> <p>18.4 Maintain the record of the performed experiment.</p> | 1 | 2 |
| 19 | <p>Perform power point presentation for different data sheet reports</p> <p>19.1 Collect data from management software</p> <p>19.2 Prepare power point presentation</p> <p>19.3 Insert data by different chart</p> <p>19.4 Present the charts as a report</p> <p>19.5 Maintain the record of the performed experiment.</p> | 1 | 2 |

| | | | |
|--------------|---|----|----|
| 20 | Perform data management systems in the wet processing industry | 2 | 3 |
| | 20.1 Identify fundamentals of database management and resources | | |
| | 20.2 Develop data-generating nodes in wet processing | | |
| | 20.3 Maintain data management system | | |
| | 20.4 Maintain the records of the performed experiment. | | |
| Total | | 32 | 50 |

Necessary Resources (Tools, Equipment, and Machinery):

| SL | Item Name | Quantity (piece/s) |
|----|--|--------------------|
| 01 | Computer (Customized) | 05 |
| 02 | Printer | 01 |
| 03 | Simulation based software (Sedo master/ Sedo Tree point/ERP) | 01 |
| 04 | Scanner | 01 |
| 05 | Spectrophotometer (Data Color-850) | 01 |
| 06 | Machine in built software | 01 |
| 07 | Different machines used in textile wet processing | 13 |

Recommended Books:

| SL | Book Name | Writer Name | Publisher Name & Edition |
|----|---------------------------------------|-----------------------|-----------------------------------|
| 01 | Soft Computing in textile engineering | Abhijit Majumdar | Woodhead publications |
| 02 | Electronic Textiles | Tilack Dias | Woodhead publications Edison 2015 |
| 03 | Digital Textile Design | <u>Melanie Bowles</u> | Cari Issac |
| 04 | Dyeing and Chemical Technology | W. Klein | E R Trotman |

Website References:

| SL | Web Link | Remarks |
|----|---|---------|
| 01 | https://www.youtube.com/watch?v=rpFrlcPlt7w | |
| 02 | https://nptel.ac.in/course | |
| 03 | https://textilelearner.net/dyehouse-management-software/ | |
| 04 | https://autogarment.com/textile-dyeing-recipe-management-system-software/ | |

Prof. Dr. Engr. Md. Zulhas Uddiin
Head, Department of
Wet Processing Engineering, BUTEX.

Engr. A. K. M. Monjurul Haque
Superintendent
Govt. Textile Vocational Institute
Narayanganj

Md. Selim Reza
CEO, Momo Fashion Ltd.

Engr. Mohammed Mahbub Alam
Chief Instructor (Computer)
Cumilla Polytechnic Institute, Cumilla

Mst. Salma Akter
Attached Officer
BTEB

Md. Rafiqul Islam
DGM
Pakiza Knit Composite Ltd.

Validated by:

Md. Nurul Absar
Junior Instructor (Tech.)
Textile Institute, Chattogram

Dr. Md. Abdul Malek
Curriculum Expert (Agr.)
BTEB, Dhaka

Dr. Muhammad Abdur Rashid
Associate Professor
Department of Textile
Engineering
DUET, Gazipur-1707

| Subject Code | Subject Name | Period per Week | | Credit |
|--------------|-------------------------|-----------------|---|--------|
| 25851 | Principles of Marketing | T | P | C |
| | | 2 | 0 | 2 |

| | |
|---------------------------------------|--|
| Rationale | <p>This subject scrutinizes the business function of Marketing. Textile students need to learn identifying the proper target market and decide upon appropriate products, services, and programs to serve these markets. Moreover, students need to know how marketers deliver value in satisfying customer needs and wants. This subject will cover areas include fundamentals of marketing, branding, consumer behavior, marketing mixes, promotion, marketing channel, international marketing, online marketing and implementation of ethics will benefit the students to gain an elementary scenario of marketing knowledge.</p> |
| Learning Outcome (Theoretical) | <p>After undergoing the subject, students will be able to:</p> <ol style="list-style-type: none"> 1. Describe marketing and marketing function. 2. Distinguish between sales and marketing 3. Interpret significance of marketing in own filed. 4. Explore opportunities of international marketing 5. Analyze marketing theories and marketing mix elements for product promotion. 6. Solve the complexity arises from market environment. 7. State classification of products marketing 8. State distribution channels 9. Explain implementation procedure of market segmentation, targeting and positioning strategies in product marketing. 10. Interpret pricing tactics to get competitive advantages. 11. Analyze branding and branding elements 12. Explain ethical marketing and its significance |

Detailed Syllabus (Theory)

| Unit | Topics with Contents | Class (1 Period) | Final Marks |
|------|---|------------------------|----------------|
| 1 | INTRODUCTION TO MARKETING 1.1 Define marketing 1.2 Explain functions of marketing 1.3 Differentiate between sales and marketing 1.4 Describe marketing prospects on the context of 4 th industrial revolution 1.5 Discuss marketing importance on apparel industry. | 4 | 6 |
| 2 | MARKETING THEORIES AND STRATEGIES 2.1. Explain core concept of marketing 2.2. Describe basic strategies and SWOT analysis of marketing 2.3. Define marketing mixes 2.4. Mention 7Ps of marketing 2.5. Compare between 4Cs and 4Ps of marketing | 4 | 7 |
| 3 | MARKET ENVIRONMENT AND INTERNATIONAL MARKETING 3.1 Describe market environment 3.2 Discuss micro environment and macro environment. 3.3 List the influential factors of market environment related with own industrial field 3.4 Define international marketing 3.5 Describe international market entry process 3.6 Classify international marketing | 3 | 7 |
| 4 | PRODUCT AND SERVICE MARKETING 4.1. Define product 4.2. Discuss good and service 4.2. Explain product life cycle 4.3. Classify product levels 4.5 Classify service marketing 4.6 Distinguish between goods and service | 3 | 7 |
| 5 | DISTRIBUTION STRATEGIES 5.1. Define distribution 5.2. State the necessity of distribution in marketing 5.3. Illustrate types of distribution channel | 2 | 4 |
| 6 | SEGMENTATION, TARGETING AND POSITIONING METHODS 6.1. Discuss market segmentation 6.2 Explain bases for consumer market segmentation 6.3 Define market targeting 6.4 Describe strategies of targeting 6.5 Define positioning, repositioning and de-positioning | 4 | 7 |

| | | | |
|-------|--|----|----|
| 7 | ESSENTIALS OF PROMOTION AND PRICING 7.1 Define promotion 7.2 State fundamentals of promotion 7.3 Relate managing customer relationships 7.4 Define price 7.5 Outline new product pricing strategies 7.6 Compare price adjustments with competitors | 4 | 7 |
| 8 | FUNDAMENTALS OF BRANDING 8.1 Define branding 8.2 List branding elements 8.3 State necessity of branding 8.4 Mention the steps of brand making process | 2 | 4 |
| 9 | CONSUMER BEHAVIOUR 9.1 Define consumer behavior 9.2 Outline stages of the buying process 9.3 Illustrate importance of studying consumer behavior 9.4 Mention the scope of consumer behavior area | 2 | 4 |
| 10 | ONLINE AND ETHICAL MARKETING 10.1 Define marketing ethics 10.2 Mention policies of marketing ethics 10.3 State the practice of ethics on virtual market. 10.4 Describe significance of the ethical practices on social media 10.4 Discuss Corporate Social Responsibility (CSR) 10.5 Discuss the consequence of green marketing | 4 | 7 |
| Total | | 32 | 60 |

Recommended Books:

| SL | Book Name | Writer Name | Publisher Name & Edition |
|----|-------------------------|-------------------------------|---|
| 1. | Principles of Marketing | Gray Armstrong/ Philip Kotler | Prentice Hall, NJ,USA 17th Edition |
| 2. | Marketing Management | Rajan Saxsena | Tata McGraw-Hill Education, 1 st Edition, 2005 |

Website References:

| SL | Web Link | Remarks |
|----|---|---|
| 1 | https://www.youtube.com/watch?v=ghFwpoH71NM | Marketing Strategy 2021: Philip Kotler on Marketing Strategy |
| 2 | https://www.youtube.com/watch?v=hZLMv5aexto | 4 Principles of Marketing Strategy Brian Tracy |
| 3 | https://www.youtube.com/watch?v=Jxe8Tgnz2SA | Secret Formula of Sales and Marketing Consumer Behavior Dr Vivek Bindra |

Prepared by,

- 1. Nowshova Ahmad**
Assistant Professor, Department of Business Administration
Shanto Mariam University of Creative Technology
- 2. Mrinmoy Mitra**
Lecturer, Department of Business Administration
Shanto Mariam University of Creative Technology
- 3. Abdullah Mohammed Ibrahim**
Associate Professor
Northern University Bangladesh
- 4. Md. Halimuzzaman**
Assistant Professor
Royal University of Dhaka
- 5. Mohammad Nurollah**
AGM, Merchandising & Marketing
Mondol Group
- 6. Md. Kamrul Hasan**
AGM, Supply Chain
Tropical Knitex
Mondol Group

| | |
|---|--|
| Validated by | |
| <hr/> Syeda Nasrin Haque Chief Instructor (Non-Tech) Bangladesh Institute of Glass and Ceramics Tejgaon, Dhaka-1208 | <hr/> Nowshova Ahmad Assistant Professor Shanto Mariam University of Creative Technology Sector 17, Uttara-1230 |

| Subject Code | Subject Name | Period/Week | | Credit |
|--------------|-----------------------|-------------|---|--------|
| 29041 | Environmental Studies | T | P | C |
| | | 2 | 3 | 3 |

| | |
|---------------------------------------|---|
| Rationale | <p>The need for sustainable development is a key to the future of mankind. Continuing problems of pollution have made everyone aware of environmental issues. Different engineering sectors have direct impact on environment. The industries are responsible for air, water, soil & sound pollution. The knowledge of environmental studies is the pre-requisite for the control of these industrial pollutions. This necessitates the introduction of environmental studies subject in the curriculum for Diploma in Engineering Course. The subject will enable the diploma engineers to identify key environmental issues & their effects, different type of pollutions, their control and remedies in the respective fields.</p> |
| Learning Outcome (Theoretical) | <p>After undergoing the subject, students will be able to:</p> <ul style="list-style-type: none"> ▪ Describe environment and environmental pollution. ▪ Explain ecology and ecosystems. ▪ Illustrate environmental degradation relating to industrial production. ▪ Mention Major environmental issues. ▪ State Legislative measures to protect the environment. |
| Learning Outcome (Practical) | <p>After undergoing the subject, students will be able to:</p> <ul style="list-style-type: none"> ▪ Test of water quality parameter. ▪ Examine of air quality. ▪ Perform the particulate matter controlling. ▪ Calculate the noise level & acoustic zone mapping. ▪ Formulate an application for Environmental Clearance Certificate. |

Detailed Syllabus (Theory)

| Unit | Topics with Contents | Class (1 Period) | Final Marks |
|------|---|------------------|-------------|
| 1 | <p>NATURE OF ENVIRONMENTAL STUDIES</p> <p>1.13 Define nature, environment & environmental studies.</p> <p>1.14 Mention the components of environment.</p> <p>1.15 Mention the scope of environmental studies.</p> <p>1.16 Define pollution, pollutant & contaminant.</p> <p>1.17 Classify different types of pollution.</p> <p>1.18 Define Natural & Man-made environment.</p> <p>1.19 Differentiate between Natural & Man-made environment.</p> <p>1.20 Discuss the green technology practices in TVET sector.</p> <p>1.21 Point out the impact of climate change.</p> <p>1.10 Discuss the importance of environmental studies.</p> | 4 | 8 |
| 2 | <p>ECOLOGY & ECOSYSTEM</p> <p>2.1 Define ecology & eco-system.</p> <p>2.2 Describe the stability of eco-system.</p> <p>2.3 Illustrate the water cycle.</p> <p>2.4 Illustrate the carbon cycle.</p> <p>2.5 Illustrate the nitrogen cycle.</p> <p>2.6 Illustrate the oxygen cycle.</p> <p>2.7 Define ecological indicator, adaptation, producers, consumers, decomposers, food chains, food webs, biodiversity, biomass, bio-concentration & bio-magnification.</p> <p>2.8 Draw Ecological Pyramid.</p> <p>2.9 Define ecologically critical area (ECA), threatened species, endanger species, extinct species, exotic species.</p> <p>2.10 List the ecologically critical areas of Bangladesh.</p> | 2 | 4 |

| | | | |
|---|--|---|---|
| 3 | <p>WATER POLLUTION</p> <p>3.1 Define water pollution.</p> <p>3.2 Mention the characteristics of ideal drinkable water.</p> <p>3.3 Classify the water pollutants.</p> <p>3.4 Mention the sources of water pollution.</p> <p>3.5 Mention the water quality standards used in the industry.</p> <p>3.6 List the value of different standards of surface water and drinking water i.e. Fe, As, TDS, TSS, DO, BOD & COD.</p> <p>3.7 Define effluents.</p> <p>3.8 Describe the methods of effluent treatment.</p> <p>3.9 Draw different schematic diagrams of effluent treatment methods.</p> <p>3.10 Discuss the effect of water pollution to the environment.</p> | 4 | 8 |
| 4 | <p>AIR POLLUTION</p> <p>4.1 Describe the atmospheric structure.</p> <p>4.2 Mention the composition of clean dry atmospheric air.</p> <p>4.3 Define air pollution.</p> <p>4.4 List the air pollutant chemical species & particulates.</p> <p>4.5 Mention the sources of air pollutants.</p> <p>4.6 Explain the formation of photochemical smog.</p> <p>4.7 Point out the effect of photochemical smog.</p> <p>4.8 Discuss the effect of air pollution on human health.</p> <p>4.9 Discuss the effect of air pollution vegetation & animal.</p> <p>4.10 Mention the impact of air pollution on materials & resources.</p> | 3 | 6 |
| 5 | <p>NOISE POLLUTION</p> <p>5.1 Define sound & sound wave.</p> <p>5.2 Mention the scale of measuring sound intensity.</p> <p>5.3 Define sound pressure & sound power.</p> <p>5.4 Describe the sound intensity and loudness.</p> <p>5.5 Define noise pollution.</p> <p>5.6 Mention the sources of noise pollution.</p> <p>5.7 Point the effect of noise pollution on human health.</p> <p>5.8 Describe the industrial noise control system.</p> | 2 | 4 |

| | | | |
|---|--|---|---|
| 6 | <p>SOIL POLLUTION</p> <p>6.1 Define soil & soil pollution.</p> <p>6.2 Classify different types of soil pollution.</p> <p>6.3 List the agro ecological zones of Bangladesh.</p> <p>6.4 Mention the sources of soil pollution.</p> <p>6.5 Mention the causes of soil degradation.</p> <p>6.6 State the effect of soil pollution.</p> <p>6.7 Describe the methods of soil pollution controlling.</p> | 2 | 4 |
| 7 | <p>SOLID WASTE MANAGEMENT</p> <p>7.1 Define solid waste, refuse, garbage, rubbish, trash, demolition & construction waste, e-waste, agricultural waste, pathological waste, radioactive waste, hazardous waste, 3R, 4R.</p> <p>7.2 List the sources of solid waste.</p> <p>7.3 Classify of solid waste.</p> <p>7.4 Illustrate the solid waste collection methods.</p> <p>7.5 Mention the waste management strategies in Bangladesh.</p> <p>7.6 Describe the recycling of solid wastes.</p> <p>7.7 Describe the resource recovery from solid waste.</p> <p>7.8 Describe the potential method of disposal of solid waste.</p> | 3 | 6 |
| 8 | <p>CHEMICAL MANAGEMENT</p> <p>8.1 Define Chemical hazard.</p> <p>8.2 Discuss different types of chemical hazard.</p> <p>8.3 Mention the toxicity of various chemical used in the industry.</p> <p>8.4 Define Hazard Pictogram.</p> <p>8.5 Illustrate different Hazard Pictograms.</p> <p>8.6 List the key points of controlling chemical exposure.</p> <p>8.7 Discuss about Personal Protective Equipment (PPE).</p> <p>8.8 Describe Hazardous waste management.</p> <p>8.9 Mention different safety signs & uses of safety signs.</p> <p>8.10 Describe chemical pesticides.</p> | 3 | 6 |
| 9 | <p>GLOBAL ENVIRONMENTAL ISSUES</p> <p>9.1 Define Greenhouse effect & Ozone depleting substances (ODS).</p> <p>9.2 List of greenhouse gases and their contribution on greenhouse effect.</p> <p>9.3 Mention the causes of global warming.</p> <p>9.4 Discuss the effect of global warming.</p> <p>9.5 Mention the causes & consequences of greenhouse effect.</p> <p>9.6 Define acid rain.</p> <p>9.7 Mention the importance of ozone layer.</p> <p>9.8 Mention different types of natural disaster.</p> | 3 | 6 |

| | | | |
|----|--|----|----|
| | 9.9 Discuss the disaster management system of Bangladesh (Flood, Cyclone & Earthquake). | | |
| 10 | REGULATORY ISSUES OF ENVIRONMENT 10.1 Mention environmental act & legislations prescribed for air, noise, water, soil & wildlife protection. 10.2 Describe environmental conservation act 1995 in Bangladesh. 10.3 Describe the environment conservation rule 1997 in Bangladesh. 10.4 Define environmental impact assessment (EIA) & environmental auditing (EA). 10.5 Describe the environmental framework in Bangladesh. 10.6 Discuss the Rio-summit 1972 & Earth summit 1992. 10.7 Describe the Montreal Protocol and The Kyoto Protocol. 10.8 Describe role of an individual in prevention of pollution. | 4 | 8 |
| | Total | 32 | 60 |

Detailed Syllabus (Practical)

| Sl. | Experiment name with procedure | Class (3 Period) | Total Marks |
|-----|---|------------------|-------------|
| 1 | Determine physical water quality of water sample 1.1 Measure temperature, color, odor & taste. 1.2 Measure turbidity of water. 1.3 Measure total suspended solids (TSS) present in water sample. 1.4 Maintain the record of performed job. | 1 | 5 |
| 2 | Determine chemical water quality of water sample 2.1 Measure pH level in water sample. 2.2 Measure Hardness in water sample. 2.3 Maintain the record of performed job. | 1 | 5 |
| 3 | Measure total dissolved solids (TDS) present in water sample 3.2 Prepare TDS meter & necessary accessories. 3.2 Read the value of TDS meter. 3.3 Maintain the record of performed job. | 1 | 5 |

| | | | |
|----|--|---|---|
| 4 | <p>Determine Iron (Fe) & Arsenic (As) level in water sample</p> <p>4.1 Prepare Iron & Arsenic test kit bottle. 4.2 Measure Iron (Fe) level in water sample. 4.3 Measure Arsenic level in water sample. 4.4 Maintain the record of performed job.</p> | 1 | 5 |
| 5 | <p>Determine the biological condition in a water body</p> <p>5.1 Prepare DO meter & necessary accessories. 5.2 Measure dissolved oxygen (DO) level present in water. 5.3 Measure biochemical oxygen demand (BOD) in water. 5.4 Maintain the record of performed job.</p> | 1 | 5 |
| 6 | <p>Determine Measure chemical oxygen demand (COD) in wastewater</p> <p>6.1 Prepare required apparatus for COD test. 6.2 Prepare reagents for COD test. 6.3 Observe COD test readings and calculate result. 6.4 Maintain the record of performed job.</p> | 1 | 5 |
| 7 | <p>Control of air dust by cyclone separator</p> <p>7.1 Prepare cyclone separator. 7.2 Observe the reading of cyclone separator. 7.3 Remove the dust from cyclone separator. 7.4 Maintain the record of performed job.</p> | 1 | 5 |
| 8 | <p>Measurement of noise level in different places</p> <p>8.1 Prepare noise meter. 8.2 Observe the reading of noise level meter. 8.3 Measure the noise level in different working area. 8.4 Maintain the record of performed job.</p> | 1 | 5 |
| 9 | <p>Perform an Application for Environmental Clearance Certificate</p> <p>9.1 Collect the Environmental Clearance Form. 9.2 Exercise the Environmental Clearance Form with respective field. 9.3 Attach the respective documents. 9.4 Maintain the record of performed job.</p> | 1 | 5 |
| 10 | <p>Perform a field visit on Effluent treatment plant (ETP)</p> <p>10.1 Observe the ETP plant. 10.2 Collect the relative data. 10.3 Prepare the diagram of observed ETP plant. 10.4 Maintain the record of performed job.</p> | 1 | 5 |

| | | | |
|--|--|-------|----|
| | | | |
| | | Total | 16 |
| | | | 50 |

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

| Sl | Item Name | Quantity |
|----|--|----------|
| 01 | Turbidity meter, P ^H meter, TDS meter, DO meter | 5 set |
| 02 | Noise Level Meter | 5 set |
| 03 | Cyclone Separator | 5 set |
| 04 | Iron & Arsenic test kit box | 5 set |
| 05 | Incubator | 1 set |
| 06 | Water Bath | 1 set |
| 07 | Glass wire, COD apparatus | 5 set |

Recommended Books:

| Sl | Book Name | Writer Name | Publisher Name & Edition |
|----|---|-----------------------------|--------------------------|
| 01 | Pollution control in process industries | S. P. Mahajan | |
| 02 | Environmental Engineering | Peavy, Rowe & Techobanglous | |
| 03 | Air pollution | V. P. Kudesia | |
| 04 | Industrial Noise Control | Bruce Fader | |
| 05 | পরিবেশ দূষণ (১ম ও ২য় খণ্ড) | আবদুল মালেক ভূঁইয়া | |
| 06 | পরিবেশ দূষণ | গৌতম পাল | |

Website References:

| Sl | Web Link | Remarks |
|----|---|---------|
| 01 | http://doe.portal.gov.bd/sites/default/files/files/doe.portal.gov.bd/page/155eebe80092_4653_907d_421dc0890e6d/aian%20sonkolon%20fff-1-100.pdf | |
| 02 | http://doe.portal.gov.bd/sites/default/files/files/doe.portal.gov.bd/page/155eebe80092_4653_907d_421dc0890e6d/aian%20sonkolon%20fff-101-200.pdf | |
| 03 | http://doe.portal.gov.bd/sites/default/files/files/doe.portal.gov.bd/page/155eebe80092_4653_907d_421dc0890e6d/aian%20sonkolon%20fff-201-366.pdf | |

Lopa Sarkar

Instructor (Tech) Environment
Pabna Polytechnic Institute
Khulna.

Md. Rokonuzzaman

Instructor (Tech) Environment
Pabna Polytechnic Institute
Pabna.

Biplab Kumar Das

Instructor (Tech) Environment
Satkhira Polytechnic Institute
Satkhira.

Tariqul Islam

Lecturer (Technical)
Textile Engineering College
Zorargonj, Chittagong.

Engr. Mst. Salma Akter

Attached officer,
BTEB, Dhaka.

Mohamed Abul Shahin

Kowser Sarker
Deputy Controller (Diploma)
BTEB, Dhaka.

Shahanaj Rahman

Deputy Director
Department of Environment
Ministry of Environment,
Forest & Climate Change.

Md. Matiar Rahman

Principal
BHETI, Bangladesh Tat Board
Ministry of Textiles and Jute.