

5.1 EMPLOYABILITY SKILLS – I

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RATIONALE

The present day world requires professionals who are not only well qualified and competent but also possess good communication skills. Our diploma students not only need to possess subject related knowledge but also soft skills to get good jobs or to rise steadily at their work place. The objective of this subject is to prepare students for employability in job market and survive in cut throat competition among professionals.

DETAILED CONTENTS

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| 1. | Writing skills | (08 hrs) |
| | i) Official and business correspondence | |
| | ii) Job application - covering letter and resume | |
| | iii) Report writing - key features and kinds | |
| 2. | Oral Communication Skills | (20 hrs) |
| | i) Giving advice | |
| | ii) Making comparisons | |
| | iii) Agreeing and disagreeing | |
| | iv) Taking turns in conversation | |
| | v) Fixing and cancelling appointments | |
| 3. | Generic Skills | (04 hrs) |
| | i) Stress management | |
| | ii) Time management | |
| | iii) Negotiations and conflict resolution | |
| | iv) Team work and leadership qualities | |

5.2 ENVIRONMENTAL EDUCATION

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RATIONALE

Education about environment protection is a must for all the citizens. In addition, a diploma holder must have knowledge of different types of pollution caused by industries and construction activities so that he may help in balancing the eco system and controlling pollution by adopting pollution control measures. He should also be aware of environmental laws related to the control of pollution.

DETAILED CONTENTS

1. Definition, Scope and Importance of Environmental Education (02 hrs)
2. Basics of ecology, biodiversity, eco system and sustainable development (03 hrs)
3. Sources of pollution - natural and manmade, causes, effects and control measures of pollution (air, water, noise, soil, radioactive and nuclear) and their units of measurement (12 hrs)
4. Solid waste management – Causes, effects and control measures of urban and industrial waste (06 hrs)
5. Mining and deforestation – Causes, effects and control measures (04 hrs)
6. Environmental Legislation - Water (prevention and control of pollution) Act 1974, Air (Prevention and Control of Pollution) Act 1981 and Environmental Protection Act 1986, Role and Function of State Pollution Control Board, Environmental Impact Assessment (EIA) (10 hrs)
7. Role of Non-conventional Energy Resources (Solar Energy, Wind Energy, Bio Energy, Hydro Energy) (04 hrs)
8. Current Issues in Environmental Pollution – Global Warming, Green House Effect, Depletion of Ozone Layer, Recycling of Material, Environmental Ethics, Rain Water Harvesting, Maintenance of Groundwater, Acid Rain, Carbon Credits. (07 hrs)

INSTRUCTIONAL STRATEGY

The contents will be covered through lecture cum discussion sessions. In addition, in order to have more appreciation of need for protection of environment, it is suggested that different activities pertaining to Environmental Education like video films, seminars, environmental awareness camps and expert lectures may also be organized.

RECOMMENDED BOOKS

1. Environmental Engineering and Management by Suresh K Dhameja; SK Kataria and Sons, New Delhi.
2. Environmental Science by Dr. Suresh K Dhameja; SK Kataria and Sons, New Delhi.
3. Environmental and Pollution Awareness by Sharma BR; Satya Prakashan, New Delhi.
4. Environmental Protection Law and Policy in India by Thakur Kailash; Deep and Deep Publications, New Delhi.
5. Environmental Science by Deswal and Deswal; Dhanpat Rai and Co. (P) Ltd. Delhi.
6. Engineering Chemistry by Jain and Jain; Dhanpat Rai and Co. (P) Ltd. Delhi.
7. Environmental Studies by Erach Bharucha; UGC University Press.

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted for Lectures (Periods)	Marks Allotted (%)
1	02	04
2	03	06
3	12	24
4	06	12
5	04	10
6	10	20
7	04	10
8	07	14
Total	48	100

5.3 MASS TRANSFER – II

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RATIONALE

In this subject, the basic concepts of mass transfer are covered to enable the students to understand working of various mass transfer equipment like distillation columns, crystallizers and extractors which are used in industries.

DETAILED CONTENTS

1. Distillation (22 hrs)
 - Concept of Distillation, Vapour Liquid Equilibria, Raoult's Law, Dalton's Law Volatility: Relative Volatility, Derivation to calculate Vapour composition and liquid composition.
 - Methods of Distillation: Differential or simple Distillation, Rayleigh's equation. Flash or Equilibrium Distillation. Material Balance, Rectification: Fractionating Column, Material Balance, McCabe Thiele Method (only procedure) Feed plate, feed line, q-line, effect of feed condition, reflux ratio, total reflux ratio, Minimum reflux ratio, optimum reflux ratio.
 - Batch Distillation, Azeotropic Distillation, Extractive Distillation, steam Distillation.
 - Equipment for distillation – plate column, packed column. Concept of flooding, Weeping, Entrainment and loading in distillation columns.

2. Leaching and Extraction (12 hrs)
 - Extraction: Definition and application of extraction, (final expression and physical meaning of terms therein, no derivation) equipment: mixer settler, spray and packed extraction towers, perforated plate extraction tower, agitated tower extractor.
 - Leaching: Definition and application of leaching, equipment: leaching through stationary solid beds, moving beds, ideal stages in counter current leaching.

3. Crystallization (10 hrs)
- Concept of crystallization, saturation and super saturation and solubility curve, mechanism of crystallization/crystal formation, method of super saturation – Miers saturation theory.
 - Classification of crystallizers – construction and working of agitated tank crystallizer, draft tube, baffle tube crystallization, Swenson and walker crystallizer, vacuum crystallizer.
4. Adsorption (10 hrs)
- Concept of Adsorption operation, types of adsorption and nature of adsorbent, effect of temp. on adsorption and industrial application, adsorption isotherms.
5. Membrane Separation (10 hrs)
- Introduction to Membrane Separation, Types of Membrane, Membrane Separation Processes, Brief Introduction: reverse osmosis, microfiltration, ultra filtration, dialysis.

LIST OF PRACTICALS

1. To separate given solution mixture with the help of a bubble cap distillation column.
2. To draw calibration curve for a given mixture using refractive index and to find out the unknown concentration from this calibration curve.
3. Experiment on extraction of oil from solids
4. Experiment on crystallizer
5. To study the reverse osmosis set up
6. To separate a mixture of two liquids using liquid extraction
7. To verify Rayleigh's equation using batch distillation set up.

INSTRUCTIONAL STRATEGY

Field visit will make the students familiar with different types of column (packed/tray), different types of packing used in the column, different types of extractors and membrane separation techniques. This will also make the students aware of auxiliary equipment/model/ supports for different equipments. Emphasis should also be given to problem solving and practices especially for distillation column and extraction.

RECOMMENDED BOOKS

1. Mass Transfer Operations by Treybal, Kogakusha Publication
2. Introduction to Chemical Engineering by Badger and Banchero; McGraw Hill Publication
3. Unit Operations of Chemical Engineering by Mc Cabe and Smith; McGraw Hill Publication
4. Mass Transfer by Sherwood Pigford and Wilke; McGraw Hill Publication
5. Chemical Engineering Handbook by Perry and Chilton; McGraw Hill Publication
6. Mass Transfer by K.A Gavhane, Nirali Publication

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Hrs)	Marks Allotted Hrs
1	22	35
2	12	20
3	10	15
4	10	15
5	10	15
Total	64	100

5.4 STOCK PREPARATION - II

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RATIONALE

The treatment of this subject to the students will be pivoted to make them understand that operational processes for making paper are just like that of a kitchen in a household. The change of properties of paper based on mixing and blending of various chemicals and combination of fibers will be stressed upon.

DETAILED CONTENTS

1. Introduction to sizing materials used in paper industry, methods of preparation of resin size by hot and cold processes, wet strength chemicals, process of internal and surface sizing (6 hrs)
2. Alum, methods of preparation of alum solution and concentration measurement procedures, substitutes for alum (4 hrs)
3. Different types of loading materials and their specific functions in relation to grades of papers produced (6 hrs)
4. Various types of beater additives like starch, guar gum, CMC, retention aids and their effect upon the paper quality, pigments and colouring matter (6 hrs)
5. Introduction to different dyes, pigments and colouring matter added to the stock shade matching (4 hrs)
6. Fiber recovery systems-flotation type, filtration type and sedimentation type (6 hrs)
7. Flow diagrams of various stock systems-illustrating stock chest agitators and other equipments (8 hrs)
8. Simple numericals based on consistency and chemicals added to the pulp (8 hrs)

LIST OF PRACTICALS

1. To determine the moisture content of bleached/unbleached pulp sample and to prepare the pulp slurry of given consistency, with the help of hydrapulper or disintegrator
2. To determine the consistency of a given pulp sample in laboratory with the help of consistency measuring apparatus and analytically to measure the percentage error of the apparatus

3. To beat a given sample of pulp for a specific period of time and note down the °SR
 - i) beating time Vs °SR
 - ii) beating time Vs °CSF
 - iii) beating time vs. change in temperature
 - iv) time vs drainage time
4. To prepare hand sheets of beaten pulp using various dosing of rosin and alum and to check the Cobb value
5. To classify the various fibers with the help of fiber classifier
6. To beat a pulp sample with the help of double disc refiner and by valley beater to compare the efficiency of both the apparatus (for different loads)
7. To prepare the various hand made paper sheets on the BSF of beaten pulp of various °SR and compare their strength properties vs. degree of beating and to plot their curves like:
 - i) °SR vs tearing strength
 - ii) °SR vs double fold
 - iii) °SR vs tensile strength
 - iv) °SR vs bursting strength
8. Analysis of alum powder
9. To measure the °SR and °CSF of a given pulp slurry
10. Fluff test of paper sample

INSTRUCTIONAL STRATEGY

This is one of the important area in the Pulp and Paper industry. Field visit to paper industries is very essential to make the students aware of the latest method used in stock preparation.

RECOMMENDED BOOKS

1. Handbook of Pulp and Paper Technologists by G.A. Smook
2. Handbook of Paper Technology by K.W. Britt
3. Handbook of Paper Technology by C. Biermann
4. Pulp and Paper: chemistry and Chemical Technology, Vol. II by J.P. Casey

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Hrs)	Marks Allotted (%)
1	06	12
2	04	10
3	06	12
4	06	12
5	04	10
6	06	12
7	08	16
8	08	16
Total	48	100

5.5 PAPER MAKING - II

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RATIONALE

Some of the operations in the paper making process will be covered in this subject such as multi-ply forming, drying, calendaring etc. Broad ideas of paper defects and trouble shooting measures along with startup and shut down procedures must be emphasized. A snapshot view of finishing house operation will also be covered.

DETAILED CONTENTS

1. General practicals for paper machine safety and recommended safety reminders (3 hrs)
2. Fundamentals of multi-ply forming, general description of twin-wire former, multi-ply paper board and paper products (5 hrs)
3. Basic Theory of drying, arrangement and operation of conventional cylinder drying, steam and condensate system, evaporation, dryer ventilation systems, pocket ventilation system, hoods and hood exhaust, dryer felts (10 hrs)
4. Theory, mechanism and principles of yankee dryers, the creeping process (4 hrs)
5. Operations of calendars, operating variables for calendar stacks (3 hrs)
6. Working and operation of super-calendars, effect of paper properties on super-calendaring embossing (5 hrs)
7. Purpose of finishing section, general description of finishing house winders and rewinders (6 hrs)
8. Simple numerical problems based on paper moisture after presses and dryers, steam requirement in dryer part, to calculate the number of dryers required in dryer part, to calculate the speed of dryer, calculation of paper production etc (8 hrs)
9. Introduction to handmade paper, board making, craft paper, cultural and industrial paper, speciality papers like carbonless, cheque and currency papers (4 hrs)

LIST OF PRACTICALS

1. To determine bulk density of given sample of paper
2. To determine tensile strength, breaking strength and tensile index of paper sample
3. To determine bursting strength and burst factor of paper sample
4. To determine tearing strength of paper samples
5. To determine stiffness of paper sample
6. To determine the caliper of paper
7. Preparation of hand sheets of given basis weight on lab sheet format and measurement of drainage time
8. To carry out the colour matching of paper sample
9. To evaluate the folding endurance of paper sample
10. To evaluate the sizing of paper by Klemmn test
11. To conduct the Respail's test of paper sample

INSTRUCTIONAL STRATEGY

Visit to paper industry will provide the students with latest techniques of paper making through machine operations.

RECOMMENDED BOOKS

1. Handbook of Paper Technology by K,W. Britt.
2. Handbook for Pulp and Paper Technologists by GA Smook
3. Paper Making and Paper Board Making, Volume-III by MacDonald
4. Pulp and Paper Manufacture, Volume-7 by Benjamin A. Thorp, Michael J. Kocured
5. Paper Machine Manual for Operators by J. Mordon
6. Handbook of Paper Technology by C. Biermann

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Hrs)	Marks Allotted (%)
1	03	05
2	05	10
3	10	20
4	04	10
5	03	05
6	05	10
7	06	10
8	08	20
9	04	10
Total	48	100

5.6 COMPUTER APPLICATIONS IN CHEMICAL INDUSTRY

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RATIONALE

In today's environment almost all the processes in chemical industry are computerized. In order to prepare diploma holders to work in this environment, this subject has been kept as a core subject. This subject will ensure the students to have proficiency in handling different types of softwares used in chemical industries.

DETAILED CONTENTS

1. Introduction (6 hrs)
Introduction to computers and its various parts; CPU, peripheral devices (Input devices : mouse, keyboard, joystick, touchpad, track ball, light pen etc. Output devices: printers, monitors, speakers etc.)
2. Hardware and Software (Application software and system software). (6 hrs)
3. Introduction to various computer generations (I to V Generations) and their development : Languages : Machine language, Assembly language, High level languages. (5 hrs)
4. Types of Computers: Personal Computers, Minicomputers, Microcomputers, Mainframe and Supercomputers, Based on the data handled: Digital, Analog and Mixed Computers. (4 hrs)
5. Concept of timesharing, multiprogramming, multi-testing and real time processing. (3 hrs)
6. Application software like: MS-Word, MS-Excel and MS-Powerpoint. (12 hrs)
7. Simple programmes related to Chemical Industry in Excel (8 hrs)
Example:
 - Calculation of area of Heat Exchanger
 - Calculation of area of cylinder
 - Conversion of Unit ($^{\circ}\text{F}$ to $^{\circ}\text{C}$)
 - Calculation of velocity from volumetric flow rate and area
8. Introduction to Internet (4 hrs)
Types of connections/networks : LAN, MAN, WAN, dial-up, leased. History of internet, usage of internet, email etc.

INSTRUCTIONAL STRATEGY

The subject will require theory as well as practical aspects of the use of computer beginning with introduction of computers, its various parts and its different generations. The main emphasis will be on the use of MS Office and also solving simple programmes related to chemical engineering.

RECOMMENDED BOOKS

1. Introduction to computers by A. Leon and Leon
2. Algorithm and Data Structure Program by Wirth, PHI
3. The Art of Computer Programming by Kruth, Addison Wesley Publication
4. A First Course in Computers by Sanjay Saxena, 2000, Vikas Publication

5.7 CHEMICAL RECOVERY

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RATIONALE

The importance of black liquor as energy and chemical source and the technological overview based on structural diagrams should be purported to the students to attain skills in operation, maintenance and trouble shooting aspects of recovery processes. Detailed treatment of mathematical material and energy balance is not needed

DETAILED CONTENTS

1. Introduction to BL recovery, Flow Sheet: Physical properties and chemical composition of soda and sulphate black liquor, simple numerical problems on total solids present in black liquor, physical characteristics of soda and sulphate black liquor (4 hrs)
2. Brief description of black liquid oxidizers to remove silica and odour from black liquor (4 hrs)
3. Different common terms in paper mill recovery unit like sulphidity, causticity, reduction efficiency, causticizing efficiency, simple calculations of terms (7 hrs)
4. Brief description of various evaporators, feeding arrangement, working operation of multiple effect evaporators and their start up and shut down procedure, simple problems for calculations of solids concentration in single effect evaporators (7 hrs)
5. Brief description of direct contact evaporators like cascade evaporator, venturi scrubber and cyclone evaporator, incineration of black liquor and reaction involved, construction details of recovery furnace (14 hrs)
6. Green liquor, dreg washer, slacking and causticizing of green liquor, white liquor classification and total cycle of causticizing process, lime mud washing process, simple numericals based on causticizing and on-line mud washer (8 hrs)
7. Lime mud handling, lime kiln and reburning of lime sludge (4 hrs)

LIST OF PRACTICALS

1. To find out the residual active alkaline in their black liquor sample
2. To find out the °Tw and °Be of a black liquor sample
3. To draw a curve between °Tw and solids content concentration in a black liquor sample
4. Analysis of black liquor (to find out the organic and inorganic content and various ingredients)
5. Analysis of salt cake
6. To find out the purity of available lime sample

7. Analysis of smelt of recovery furnace
8. To find out the residual alkali and lime in a lime mud sample
9. Analysis of green liquor sample
10. To find out the purity of soda ash
11. To find out the reduction ratio of salt cake in the smelt
12. To find out the temporary and permanent hardness of water
13. To draw a curve between °Tw and specific gravity

INSTRUCTIONAL STRATEGY

The focus should be laid to develop skills in operation, maintenance and trouble shooting of recovery processes. Industrial visit will make the students familiar with black liquid oxidizer and various evaporators.

RECOMMENDED BOOKS

1. Handbook for Pulp and Paper Technologists by GA Smook
2. Handbook of Paper Technology by KW Britt
3. Handbook of Paper Technology by C Biermann

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Hrs)	Marks Allotted (%)
1	04	10
2	04	10
3	07	15
4	07	15
5	14	25
6	08	15
7	04	10
Total	48	100

5.8 MINOR PROJECT WORK

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Minor project work aims at exposing the students to field practices, size and scale of operation and work culture at practical sites. For this purpose, students during the semester are required to be sent to different work sites. Some of the good industries are as follows:

List of Industries

1. Ballarpur Industried Limited, Yamunanagar
2. Panipat Refinery, Panipat
3. National Fertilizers Ltd., Panipat
4. Bharat Starch & Chemicals Ltd., Yamunanagar
5. Karnal Coopretive Sugar Mills Ltd., Karnal
6. National Dairy Research Institute , Karnal
7. Indian Acrylic, Bhawanigarh
8. Pepsi Foods, Channo (Bhawanigarh)
9. JCT, Hissar
10. M/S Cure Quick Pharma, Karnal 20/3, HSIDC, Karnal
11. Ruchire Paper Mills Ltd., Kala amb
12. NFL, Nangal
13. PACL Nangal
14. Max GB. Ropar
15. Ranbaxy, Ropar
16. Shreyans Paper Mill, Ropar
17. PCPL Derabassi
18. SIEL Complex, Rajpura
19. JIL, Hamira
20. Rana Sugar Mill, Bulter
21. Trident, Barnala
22. IAL, Saugrur
23. Barnala Paper Mill
24. Paper Mill, Jagadhari
25. Thermal Plant, Panipat
26. NFL, Bathinda
27. Sukhjit Starch and Chemicals, Phagwara
28. Horlicks, Nabha
29. NESTLE, Ferozpur Road, Moga
30. K.B.R.L., Dhruj-Malerkotla Road, Bhasaur, Dist Sarangrur
31. Oswald Oils and Fats, Raikot
32. A.P Solvex Ltd. Dhuri
33. Shreyans Paper Mills, Ahmedgarh
34. Ind Swift- Barwala road, Chandigarh
35. Panecea BioTech – Lalroo
36. Morpen Pharmaceuticals, Parwanoo
37. Sanchez Pharmaceuticals, Tohana, Tricrossing Tohana, Distt. Fatehabad

38. Wochert, Ambala-Chandigarh. Road, Lalroo
39. Amrit Vanaspati, Rajpura
40. Diplast Industries, Mohali
41. Mount Shivalik Breweries, Derabassi
42. PCPL Chemicals, Derabassi

As a minor project activity, each student is supposed to study the material and technologies used at site and prepare a detailed project report of the observation of processes seen by him/her. The students should be supervised and guided by respective subject teachers. Each teacher may guide a group of four to five students.

The teacher along with field supervisors will conduct performance assessment of students. The components of evaluation will include the following:

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| a) | Punctuality and regularity | 15% |
| b) | Initiative in learning new things | 15% |
| c) | Relationship with workers | 15% |
| d) | Industrial training report | 55% |