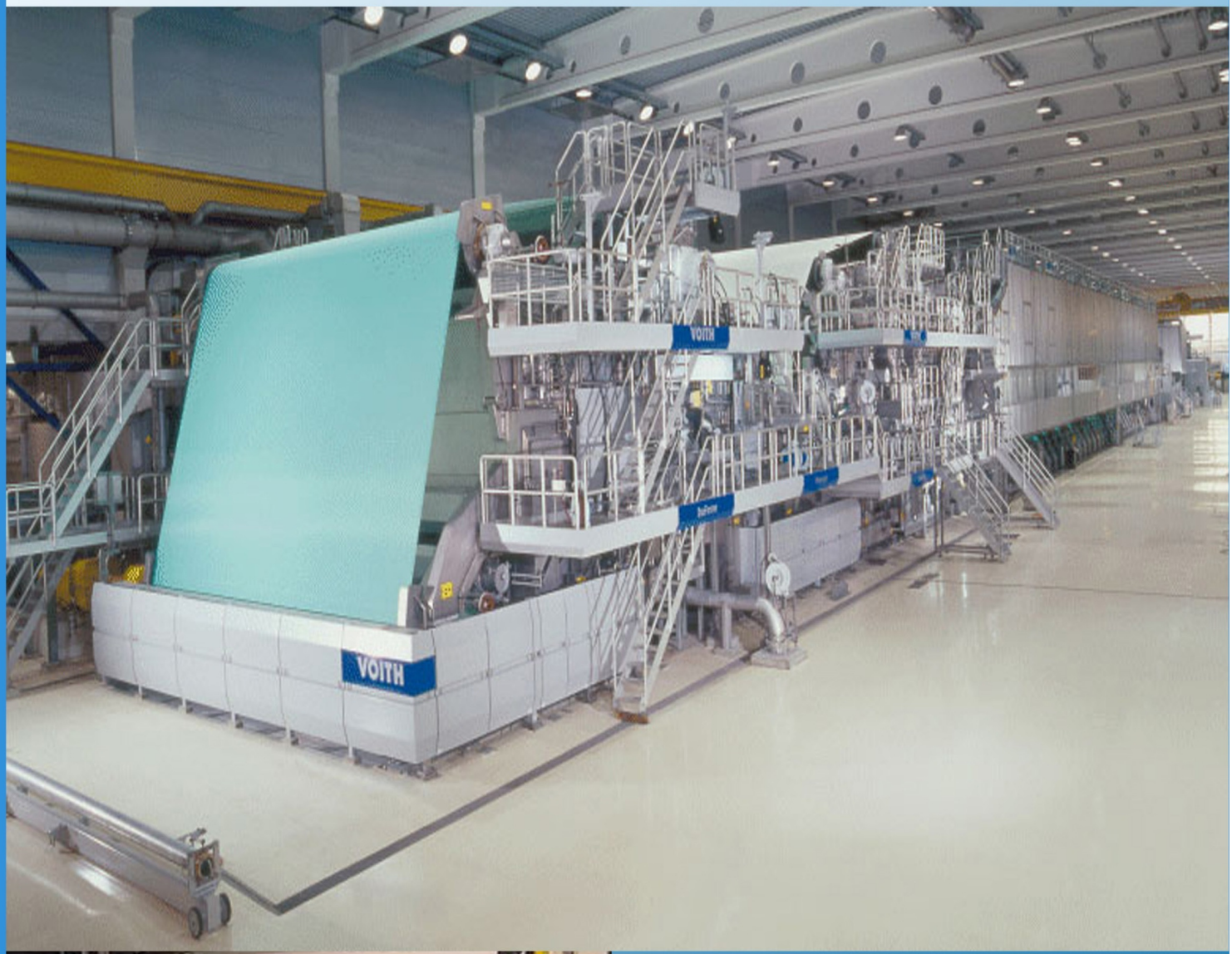
THE SESHASAYEE INSTITUTE OF TECHNOLOGY

(AUTONOMOUS)

TIRUCHIRAPPALLI - 620 010. Est. 1952

# DEPARTMENT OF PAPER TECHNOLOGY

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## PREFACE

Tech Man Power need is on the increase day by day. The academic students of Diploma in Paper Technology., is made to fit this fast paced result oriented present conditions. This happens due to the implementation of scientific approach, rather than as earlier said “Paper Making is an Art.”

Our living planet becomes Global Village and shrinks every second. We made use of the powerful tools such as experience, knowledge and expertise. This modified syllabus is designed to understand easily and clearly. This is the only integrated course in South India.

To suit to the modern trend updated technology is vital to start their career followed by promotions and improvements to the next stage. This syllabus is designed to suite the students in a better way. Polytechnics play a major role to give a gentle start of one’s career with technical knowledge in their early teens or prior to the age of twenty.

The success of the course depends on its effective implementation. To fulfill the need of multifaceted newly designed opportunities and jobs the technical qualifications is mandatory. The students are focused to fill these needs.

The crème of this sand-which pattern course is providing two Full semester in-plant training in leading Paper mills such as Tamil Nadu Newsprint & Papers Limited., Karur, Seshasayee Paper& Boards Limited, Erode and Emami Paper mills Ltd., Orissa. The students undergoes In Plant training as per the act of apprentiship Training of Government of India.

**PRINCIPAL & CHAIRMAN**

## ACKNOWLEDGEMENTS

We gratefully acknowledge the assistance and guidance received from

1. Commissioner, Technical Education and Secretary, Higher education taking keen interest and support in the revision of this curriculum.
2. Chairman, Managing Director, Seshasayee Paper & Boards Ltd., Erode.
3. General Manager (Paper), Deputy General Manager ( Lab & R&D),Tamilnadu Newsprint & Papers Ltd.
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5. Dr. P. Marimuthu, Deputy General Manager Lab & R&D. SPB Ltd. Erode. For his sustained guidance and support in the revision of this curriculum.

**Co-ordinator**

## 1. DEPARTMENT VISION,MISSION,PO AND PEOs

**The Vision and Mission of the Department**

**Vision**

To produce competitive, responsive, globally competent paper technologists to cater the needs of the industries.

**Mission**

- Integrate the self sustainable education with basic teaching- learning process with need based curriculum.
- Inculcate logical thinking, creativity and effective communication skills.
- Cultivate awareness of emerging trends in paper technology field through self learning.
- To create a sense of social concerns, humanitarian services and ethics.
- To motivate lifelong learning and creating good resources.

**Programme Outcomes (PO's)**

After completion of the programme the student should be able to

1. Apply the basic knowledge of mathematics, Science, Chemistry and engineering to solve the problems in paper technology.
2. Identify and analyse the problems in paper industries and arrive at appropriate solutions.
3. Develop and evaluate operations of paper processes.
4. Trouble shoot the problems in case of plant operations.
5. Use the appropriate technique, skills and modern engineering tools in paper industries.
6. Understand the professional, social issues and responsibilities.
7. Understand the impact of engineering solutions on environment and global economics.
8. Apply principles of ethics in professional practices.
9. Function effectively as an individual and in team.
10. Communicate effectively to present ideas and thoughts.

11. Incorporate appropriate economics and business practices for project, risk and change management.
12. Self improvements through continuous lifelong learning to update the knowledge of changes in technology.

**Programme Educational Objectives (PEOs)**

1. Lead a successful career as an employee or an entrepreneur in the field of paper technology and allied fields.
2. Adopt the latest changes and developments in the field of paper technology by updating knowledge and skills.
3. Exhibit effective communication skills to present his or her ideas and thoughts efficiently.
4. Able to work effectively as an individual, in multi disciplines, multicultural environments and society at large.

# 2. R E G U L A T I O N S

**DIPLOMA COURSES IN ENGINEERING (TERM PATTERN)**
**(Implemented from 2020- 2021) F– SCHEME**

**(Common to all Programmes)**

## 2.1. Description of the Course:

a. Full Time (3 years)
The Programme for the Full Time Diploma in Engineering shall extend over a period of three academic years, consisting of 6 terms* and the First Year is common to all Engineering Branches.

b. Sandwich (3½ years)
The Course for the Sandwich Diploma in Paper Technology shall extend over a period of three and half academic years, consisting of 7 terms* and the First Year is common to all Engineering Branches. The subjects of three years full time diploma course being regrouped for academic convenience. During 4th and/or during 7th term the students undergo industrial training for six months. Industrial training examination will be conducted after completion of every 6 months of industrial training.

** Each term will have 16 weeks duration of study with 35 hrs. / Week for Regular Diploma Courses.*

## 2.2. Condition for Admission:

Condition for admission to the Diploma courses shall be required to have passed in

The S.S.L.C Examination of the Board of Secondary Education, Tamil Nadu.

(or)

The Anglo Indian High School Examination with eligibility for Higher Secondary Course in Tamil Nadu.

(or)

The Matriculation Examination of Tamil Nadu.

(or)

Any other Examinations recognized as equivalent to the above by the Board of Secondary Education, Tamil Nadu.

**Note:** In addition, at the time of admission the candidate will have to satisfy certain minimum requirements, which may be prescribed from time to time.

## 2.3. Admission to Second year (Lateral Entry):

A pass in HSC (academic) or (vocational) courses mentioned in the Higher Secondary Schools in Tamil Nadu affiliated to the Tamil Nadu Higher Secondary Board with eligibility for University Courses of study or equivalent examination & Should have studied the following courses.

A pass in 2 Years ITI with appropriate Trade or Equivalent examination.

| Sl. No | Courses | H.Sc Academic | H.Sc Vocational | | Industrial Training Institutes Courses |
|---|---|---|---|---|---|
| | | | Subjects Studied | | |
| | | Studied any three of the following subjects | Studied any three of the following subjects | Vocational subjects | |
| 1 | All the Regular and Sandwich Diploma Courses | • Maths<br>• Physics<br>• Chemistry<br>• Computer Science<br>• Electronics<br>• Information Technology<br>• Biology<br>• Informatics Practices<br>• Bio Technology<br>• Technical Vocational subject<br>• Agriculture<br>• Engineering Graphics<br>• Business Studies<br>• Entrepreneurship | • Maths<br>• Physics<br>• Chemistry<br>• Computer Science<br>• Electronics<br>• Information Technology<br>• Biology<br>• Informatics Practices<br>• Bio Technology<br>• Technical Vocational subject<br>• Agriculture<br>• Engineering Graphics<br>• Business Studies<br>• Entrepreneurship | Related Vocational Subjects Theory& Practical | 2 years course to be passed with appropriate Trade |

- For the Diploma Programmes related with Engineering/Technology, the related / equivalent courses prescribed along with Practical's may also be taken for arriving the eligibility.
- Programmes will be allotted according to merit through counseling by the Principal as per communal reservation.
- Candidates who have studied Commerce Courses are not eligible for Engineering Diploma Programmes.

**2.4.** Age Limit:

No Age limit.

**2.5. Medium of Instruction**: English

**2.6. Eligibility for the Award of Diploma:**

No candidate shall be eligible for the Diploma unless he/she has undergone the prescribed course of study for a period of not less than 3/3 ½ academic years (Full Time/Sandwich), affiliated to the State Board of Technical Education and Training, Tamil Nadu, when joined in First Year and 2/2 ½ years (Full Time/Sandwich), if joined under Lateral Entry scheme in the second year and passed the prescribed examination.

The minimum and maximum period for completion of Diploma Programmes are given below:

| Diploma Programmes | Minimum Period | Maximum Period |
|---|---|---|
| Full Time | 3 Years | 6 Years |
| Full Time (Lateral Entry) | 2 Years | 5 Years |
| Sandwich | 3½ Years | 6½ Years |
| Sandwich (Lateral Entry) | 2½ Years | 5½ Years |

*This will come into effect from F Scheme onwards i.e. from the academic year 2020-2021.*

**2.7. Programmes of Study and Curriculum outline**

The Programmes of study shall be in accordance with the syllabus prescribed from time to time, both in theory and practical courses.

*The curriculum outline is given in Annexure – I.*

**2.8. Examinations:**

Autonomous Examinations in all Programmes of all the terms under the scheme of examinations will be conducted at the end of each term.

The internal assessment marks for all the courses will be awarded on the basis of continuous assessment earned during the term concerned. For each course, 25 marks are allotted for internal assessment. Autonomous Examinations are conducted for 100 marks and reduced to 75.

**The total marks for result are 75 + 25 = 100 Marks.**

**2.9. Continuous Internal Assessment:**

**A. For Theory Courses:**

The Internal Assessment marks for a total of 25 marks, which are to be distributed as follows:

**i) Course Attendance** **5 Marks**

*(Award of marks for subject attendance to each subject Theory/Practical will be as per the range given below)*

| | |
|---|---|
| **80% - 83%** | **1 Mark** |
| **84% - 87%** | **2 Marks** |
| **88% - 91%** | **3 Marks** |
| **92% - 95%** | **4 Marks** |
| **96% - 100%** | **5 Marks** |

**ii) Test #** **10 Marks**

Two Tests each of 2 hours duration for a total of 50 marks are to be conducted. Average of these two test marks will be taken and the marks to be reduced to:

***05 Marks***

The Test – III is to be the Model Examination covering all the five units and the marks obtained will be reduced to:

***05 Marks***

| Test | Units | When To Conduct | Marks | Duration |
|---|---|---|---|---|
| **Test I** | Unit – I & Half of Unit II | End of 6th week | 50 | 2 Hrs |
| **Test II** | Remaining Half of Unit II & III | End of 12th week | 50 | 2 Hrs |
| **Test III** | Model Examination: Covering all the 5 Units. (Autonomous Examinations- Question paper-pattern). | End of 16th week | 100 | 3 Hrs |

*# From the Academic Year 2020 – 2021 onwards.*

**Question Paper Pattern for the Cycle Test** :( Test - I & Test- II) **:**

Part A Type questions (Any 4 out of 6 questions) : 4 Questions × 2 mark 08 marks

Part B Type questions (Any 4 out of 6 questions) : 4 Questions × 3 mark 12 marks

Part C Type questions (Either or) : 3 Questions × 10 mark 30 marks

**Total** **50 marks**

**Assignment** **10 Marks**

- **Written Assignment - 4 marks**
- **Multiple Choice Questions - 3 marks**
- **Seminar Presentation - 3 marks**
- **Total - 10 Marks**

**iii) Assignment** **4 Marks**

For each course Two Assignments are to be given each for 10 marks and the average marks scored should be reduced for 4 marks.

**iv) Multiple Choice Questions** **3 Marks**

For each course one MCQ test are to be given each for 30 marks and the average marks scored should be reduced for 3 marks.

**v) Seminar Presentation** **3 Marks**

The students have to select the topics either from their course or general courses which will help to improve their grasping capacity as well as their capacity to express the subject in hand. The students will be allowed to prepare the material for the given topic using the library hour and they will be permitted to present seminar (For First and Second Year, the students will be permitted to present the seminar as a group not exceeding six members and each member of the group should participate in the presentation. For the Third Year, the students should present the seminar individually.) The seminar presentation is mandatory for all theory courses and carries 3 marks for each theory course. The respective course faculty may suggest topics to the students and will evaluate the submitted materials and seminar presentation. (1 ½ marks for the material submitted in writing and 1 ½ marks for the seminar presentation). For each subject minimum of two seminars are to be given and the average marks scored should be reduced to 3 marks.

All Test Papers, Assignment Papers / Notebooks and the seminar presentation written material after getting the signature with date from the students must be kept in safe custody in the department for verification and audit. It should be preserved for one term after publication of Board Exam results and produced to the flying squad and the inspection team at the time of inspection / verification.

**B. For Practical Subjects:**

The Internal Assessment mark for a total of 25 marks which are to be distributed as follows:-

| | | |
|---|---|---|
| **a) Attendance** | **:** | **5 Marks** (Award of marks same as theory subjects) |
| **b) Procedure / observation and Tabulation / Other Practical Related Work** | **:** | **10 Marks** |
| **c) Record writing** | **:** | **10 Marks** |
| **TOTAL** | **:** | **25 Marks** |

- All the Experiments/Exercises indicated in the syllabus should be completed and the same to be given for final Board examinations.
- The observation note book / manual should be maintained for 10 marks. The observation note book / manual with sketches, circuits, programme, reading and calculation written by the students manually depends upon the practical subject during practical classes should be evaluated properly during the practical class hours with date.
- The Record work for every completed exercise should be submitted in the subsequent practical classes and marks should be awarded for 10 marks for each exercise as per the above allocation.
- At the end of the term, the average marks of all the exercises should be calculated for 20 marks (including Observation and Record writing) and the marks awarded for attendance is to be added to arrive at the internal assessment mark for Practical. (20+5=25 marks)
- Only regular students, appearing first time have to submit the duly signed bonafide record note book/file during the Practical Board Examinations.

All the marks awarded for Assignments, Tests, Seminar presentation and Attendance should be entered periodically in the Personal Theory Log Book of the staff, who is handling the theory subject.

The marks awarded for Observation, Record work and Attendance should be entered periodically in the Personal Practical Log Book of the staff, who is handling the practical subject.

### 2.10. Communication Skill Practical, Computer Application Practical and Physical Education:

The Communication Skill Practical and Computer Application Practical with more emphasis are being introduced in First Year. Much Stress is given to increase the Communication skill and ICT skill of students. As per the recommendation of MHRD and under Fit India scheme, the Physical education is introduced to encourage students to remain healthy and fit by including physical activities and sports.

### 2.11. Project Work and Internship:

The students of all the Diploma Programme have to do a Project Work as part of the Curriculum and in partial fulfilment for the award of Diploma by the State Board of Technical Education and Training, Tamil Nadu. In order to encourage students to do worthwhile and innovative projects, every year prizes are awarded for the best three projects i.e. institution wise, region wise and state wise. The Project work must be reviewed twice in the same term. The project work is approved during the V term by the properly constituted committee with guidelines.

**a) Internal assessment mark for Project Work & Internship:**

| | | |
|---|---|---|
| **Project Review I** | **…** | **10 marks** |
| **Project Review II** | **…** | **10 marks** |
| **Attendance** | **…** | **05 marks** (Award of marks same as theory subject pattern) |
| **TOTAL** | **…** | **25 MARKS** |

Proper record should be maintained for the two Project Reviews and preserved for one term after the publication of Board Exams results. It should be produced to the flying squad and the inspection team at the time of inspection/verification.

**b) Allocation of Marks for Project Work & Internship in Board Examinations:**

| | |
|---|---|
| **Demonstration/Presentation** | **25 marks** |
| **Report** | **25 marks** |
| **Viva Voce** | **30 marks** |
| **Internship Report** | **20 marks** |
| **TOTAL** | **100* MARKS** |

**Examination will be conducted for 100 marks and will be converted to 75 marks.*

**c) Internship Report:**

The internship training for a period of two weeks shall be undergone by every candidate at the end of IV / V term during vacation. The certificate shall be produced along with the internship report for evaluation. The evaluation of internship training shall be done along with final year "Project Work & Internship" for 20 marks. The internship shall be undertaken in any industry / Government or Private certified agencies which are in social sector / Govt. Skill Centres / Institutions / Schemes.

**A neatly prepared PROJECT REPORT as per the format has to be submitted by individual student during the Project Work & Internship Board examination.**

**2.12. Scheme of Examinations:**

The Scheme of examinations for courses is given in Curriculum outline

**2.13. Criteria for Pass:**

**1.** No candidate shall be eligible for the award of Diploma unless he/she has undergone the prescribed course of study successfully in an institution approved by AICTE and affiliated to the State Board of Technical Education & Training, Tamil Nadu and pass all the subjects prescribed in the curriculum.

**2.** A candidate shall be declared to have passed the examination in a course if he/she secures not less than ***40% in theory subjects and 50%in practical subjects*** out of the total prescribed maximum marks including both the Internal Assessment and the Autonomous Examinations marks put together, course to the condition that he/she secures at least a ***minimum of 40 marks out of 100 marks in the Autonomous Theory Examinations and a minimum of 50 marks out of 100 marks in the Autonomous Practical Examinations***.

## 2.14. Classification of successful candidates:

Classification of candidates who will pass out the final examinations from April 2023 onwards (Joined first year in 2020 -2021) will be done as specified below.

**First Class with Superlative Distinction:**

A candidate will be declared to have passed in ***First Class with Superlative Distinction*** if he/she secures not less than 75% of the marks in all the courses and passes all the terms in the first appearance itself and passes all courses within the stipulated period of study 2 / 3 / 3½ years [Full time (lateral entry)/Full Time/Sandwich] without any break in study.

**First Class with Distinction:**

A candidate will be declared to have passed in ***First Class with Distinction*** if he/she secures not less than 75% of the aggregate marks in all the terms put together and passes all the terms except the I and II term in the first appearance itself and passes all courses within the stipulated period of study 2 / 3 / 3½ years [Full time(lateral entry)/Full Time/Sandwich] without any break in study.

**First Class:**

A candidate will be declared to have passed in ***First Class*** if he/she secures not less than 60% of the aggregate marks in all the terms put together and passes all the courses within the stipulated period of study 2 / 3 / 3½ years [Full time(lateral entry)/Full Time/Sandwich] without any break in study.

**Second Class:**

All other successful candidates will be declared to have passed in ***Second Class***. The above classifications are also applicable for the Sandwich students who pass out Final Examination from October 2023 /April 2024 onwards (both joined First Year in 2020 -2021).

## 2.15. Duration of a period in the Class Time Table:

The duration of each period of instruction is 1 hour and the total period of instruction hours excluding interval and lunch break in a day should be uniformly maintained as 7 hours corresponding to 7 periods of instruction (Theory & Practical).

## 3. SALIENT FEATURES OF THE DIPLOMA PROGRAMME IN PAPER TECHNOLOGY

| | |
|---|---|
| Name of the Programme | Diploma in Paper Technology |
| Duration of the Programme | Three and half years |
| Entry Qualification | Matriculation or equivalent as prescribed by State Board of Technical Education |
| Intake | 60 |
| Pattern of the Programme | Term Pattern |
| Ratio between Theory & Practical | 50:50(Approx.) |
| Industrial Training | One year industrial training in IV Term and VII Term. Internal assessment 50 marks and external assessment marks will be 50.Total marks allotted to industrial training will be 100. |
| Ecology and Environment | As per Govt. of India directives, a subject on Environmental Education has been incorporated in the scheme. |
| Entrepreneurship Development | Entrepreneurship Development and Management has been incorporated in the scheme. |

## 4. EMPLOYMENT OPPORTUNITIES

Employment opportunities for diploma in Paper Technology are visualized in following industrial at various levels / positions.

i). Chemicals and Allied Industries like

a) Pulp and Paper Industries
b) Agro Industry
c) Industries based on Agricultural residue and recycle fibre
d) Paper Chemical Industries
e) Paper Making Machineries Manufacturing Industries
f) Paper projects & Consultancies
g) Paper Fabrics Manufacturing Industries
h) Consumer goods Industries etc.
i) Polymer Industries
j) Currency Note Manufacturing Mills (Govt.)
k) Khadhi & village board Industry (Govt. of Tamil Nadu)
l) Packaging Industry
m) Book Printing corporation (Govt)

In various functional areas like erection and commissioning of Paper Plant , plant operation, production, maintenance and safety, quality control, inspection and testing, marketing and sales, consultancy service and areas concerning environmental protection.

ii). Research Organizations like CPPRI (Central Pulp & Paper Research Institute) laboratories, FRI, establishments, pollution control labs.

iii). Entrepreneurs to small / tiny units especially Paper, agro and chemicals industries.

iv). Self employed in setting up a small unit of hand made paper.

## 5. COMPETENCY PROFILE OF DIPLOMA HOLDERS IN PAPER TECHNOLOGY

Keeping in view the employment opportunities of diploma holders in Paper Technology the course is aimed at developing following knowledge and skills in the students:

1. Basic understanding of concepts and principles related to Paper Technology
2. Development of communication and interpersonal skills for effective functioning in the world of work.
3. Understanding of basic concepts and principles of mechanical, electrical and instrument, civil, engineering so as to enable the students to apply the knowledge of these principles to the field of paper and allied industries.
4. Ability to read and interpret drawings related to plant layout, process equipment and components and color codes.
5. Knowledge of various materials used in chemical processes, their properties and specifications.
6. Knowledge and associated skills of various unit operations, unit processes and process instrumentation in process industry.
7. Ability to calculate the quantity of raw materials, energy inputs, manpower requirement and output from the process.
8. Ability to select the various raw materials and additives, understanding the properties and specifications for the manufacturing of pulp and paper.
9. Understanding of complete process of making paper starting from the raw material.
10. Appreciation of the need of clean and green environment and its deterioration by various emissions from industry and preventive procedures and knowledge of safety regulations in paper industry.
11. Development of generic skills of thinking and problem – solving, communication attitudes and value system for effective functioning in a process industry.
12. Understanding of the basic principles of managing men, material and machines / equipment for optimum production.
13. Proficiency in the use of computers.
14. Basic manual and machining skills as an aid to function effectively in the process industry.
15. Knowledge of properties and conversion of paper.
16. Development of good personality in order to have effective communication and business ethics.

## 6. DERIVING CURRICULAM AREAS FROM COMPETENCY PROFILE

The following curriculum areas have been derived based on competency profile.

| S.NO | Competency | Curriculum Areas / Subjects |
|---|---|---|
| 1 | Basic understanding of concepts and principles related to applied sciences like physics, chemistry and mathematics. | - Physics<br>- Chemistry<br>- Mathematics |
| 2 | Development of communication and inter personal skill for effective functioning in the world of work. | - Communication Skills |
| 3 | Understanding of basic concepts and principles of mechanical, electrical and civil engineering so as to enable the students to apply the knowledge of these principles to the field of paper and allied industries. | - Engineering Mechanics<br>- General Workshop Practice |
| 4 | Ability to read and interpret drawings related to plant layout, process equipment and components and colour codes. | - Engineering Graphics |
| 5 | Knowledge of various materials used in chemical processes, their properties and specifications. | - Industrial Chemistry |
| 6 | Knowledge and associated skills of various unit operations, unit processes and process instrumentation in process industry | - Engineering Mechanics & Fluid Mechanics<br>- Unit Operations<br>- Process Instrumentation & Control |
| 7 | Ability to calculate the quantity of raw materials, energy inputs, manpower requirement and output from the process. | - Process Equipment Design |
| 8 | Ability to select the various raw materials and additives, understanding the properties and specifications for the manufacturing of pulp & paper. | - Ppt –I<br>- Ppt - II<br>- Ppt – III |
| 9 | Understanding of complete process of making paper starting from the raw material | - Ppt –I<br>- Ppt - II<br>- Ppt – III<br>- Chemical Recovery |
| 10 | Appreciation of the need of clean and green environment and its deterioration by various emissions from industry and preventive | - Environmental Education<br>- Pollution Control In Chemical Process Industry |

| | | |
|---|---|---|
| | procedures and knowledge of safety regulations in paper industry. | |
| 11 | Development of generic skills of thinking and problem-solving, communication, attitudes and value system for effective functioning in a process industry | - Industrial Visits<br>- Project Work |
| 12 | Understanding of the basic principles of managing men, material and machines / equipment for optimum production | - Entrepreneurship Development And Plant Engineering & Management |
| 13 | Proficiency in the use of computers | - Computer Applications In Paper Industries |
| 14 | Basic manual and machining skills as an aid to function effectively in the process industry | - General Workshop Practice |
| 15 | Knowledge of properties and conversion of paper | - Paper Properties And Conversion |

# III TERM

| Sl. No | Course Code | Course | Abbr | Hours Per Week | | | | | Scheme of Examination | | | Minimum mark For Pass | Duration Of Exam (Hours) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | TH | TU | P | Total Hours | C | Internal | External* | Total | | |
| **1** | 5F 3204 | Industrial Chemistry | IC | 5 | | | 5 | 5 | 25 | 100 | 100 | 40 | 3 |
| **2** | 5F 3205 | Basic's Of Mechanical Engineering | BME | 5 | | | 5 | 5 | 25 | 100 | 100 | 40 | 3 |
| **3** | 5F 3301 | Pulp & Paper Technology I | PPT -1 | 5 | | | 5 | 5 | 25 | 100 | 100 | 40 | 3 |
| **4** | 5F 3206 | Electrical & Electronics Engineering | EEE | 5 | | | 5 | 5 | 25 | 100 | 100 | 40 | 3 |
| **5** | 5F 3401 | Plant Engineering Management & Environmental Engineering | PME & EE | 4 | | | 4 | 4 | 25 | 100 | 100 | 40 | 3 |
| **6** | 5F 3302 | Pulp Technology Laboratory | PT Lab | | | 4 | 4 | 2 | 25 | 100 | 100 | 50 | 3 |
| **7** | 5F 3207 | General Engineering practical | GE Lab | | | 4 | 4 | 2 | 25 | 100 | 100 | 50 | 3 |
| | | | | **24** | | **8** | **32** | **28** | | | | | |
| | | Physical Education | P.Ed | | | | **2** | | | | | | |
| | | Library | Lib | | | | **1** | | | | | | |
| | **TOTAL** | | | | | | **35** | **28** | | | | | |

***External Marks are conducted for 100 Marks and converted to 75 Marks**
**Abbr- ABBRIVATION TH –THEORY TU – TUTORIAL P – PRACTICAL C – CREDIT**

# IV TERM

| Sl. No | Course Code | Course | Abbr | Hours Per Week | | | | | Scheme of Examination | | | Minimum mark For Pass | Duration Of Exam (Hours) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | TH | TU | P | Total Hours | C | Internal | External* | Total | | |
| **1** | 5F4303 | Pulping Operation Electrical and Mechanical Maintenance | POE MM | | | 24 | 24 | 12 | 25 | 100 | 100 | 50 | 3 |
| **2** | 5F4304 | Chemical Recovery Operation and Maintenance | CRO MM | | | 24 | 24 | 12 | 25 | 100 | 100 | 50 | 3 |
| | **TOTAL** | | | | | **48** | **48** | **24** | | | | | |
| | 5F0005 | Concurrent career Development** | CCD | | | | | 5 | 25 | 100 | 100 | 40 | 3 |

***External Marks are conducted for 100 Marks and converted to 75 Marks**
**Abbr- ABBRIVATION TH –THEORY TU – TUTORIAL P – PRACTICAL C – CREDIT**
**** The total hours allotted for taking CCD is 75 Hrs and will be handled with flexible timings**

# V TERM

| Sl. No | Course Code | Course | Abbr | Hours Per Week | | | | | Scheme of Examination | | | Minimum mark For Pass | Duration Of Exam (Hours) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | TH | TU | P | Total Hours | C | Internal | External* | Total | | |
| **1** | 5F5305 | Pulp And Paper Technology II | **PPT – II** | 6 | | | 6 | 6 | 25 | 100 | 100 | 40 | 3 |
| **2** | 5F5208 | Unit Operations | **UO** | 5 | | | 5 | 5 | 25 | 100 | 100 | 40 | 3 |
| **3** | 5F5402 | Process Instrumentation And Control | **PIC** | 5 | | | 5 | 5 | 25 | 100 | 100 | 40 | 3 |
| **4** | 5F5209 | Entrepreneurship and Startups | **ES** | | | 4 | 4 | 2 | 25 | 100 | 100 | 50 | 3 |
| **5** | 5F5210 | Unit Operations Laboratory | **UO Lab** | | | 4 | 4 | 2 | 25 | 100 | 100 | 50 | 3 |
| **6** | 5F5211 | Environmental Engineering Laboratory | **EE Lab** | | | 4 | 4 | 2 | 25 | 100 | 100 | 50 | 3 |
| **7** | 5F5403 | Process Instrumentation And Control Laboratory | **PIC Lab** | | | 4 | 4 | 2 | 25 | 100 | 100 | 50 | 3 |
| | | | | **16** | | **16** | **32** | **24** | | | | | |
| | | Physical Education | **P.Ed** | | | | **2** | | | | | | |
| | | Library | **Lib** | | | | **1** | | | | | | |
| | **TOTAL** | | | | | | **35** | **24** | | | | | |
| | 5F0006 | Universal Human Values** | **UHV** | | | | | **5** | 25 | 100 | 100 | 40 | 3 |

***External Marks are conducted for 100 Marks and converted to 75 Marks**
**Abbr- ABBRIVATION TH –THEORY TU – TUTORIAL P – PRACTICAL C – CREDIT**
**** The total hours allotted for taking UHV is 75 Hrs and will be handled with flexible timings**

# VI TERM

| Sl. No | Course Code | Course | Abbr | Hours Per Week | | | | | Scheme of Examination | | | Minimum mark For Pass | Duration Of Exam (Hours) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | TH | TU | P | Total Hours | C | Internal | External* | Total | | |
| **1** | 5F6306 | Chemical Recovery | **CR** | 5 | | | 5 | 5 | 25 | 100 | 100 | 40 | 3 |
| **2** | 5F6307 | Pulp And Paper Technology III | **PPT – III** | 5 | | | 5 | 5 | 25 | 100 | 100 | 40 | 3 |
| **3** | 5F6308 | Process Design Concept | **PDC** | 4 | | | 4 | 4 | 25 | 100 | 100 | 40 | 3 |
| **4** | 5F6309 | Paper Technology Laboratory | **PAT Lab** | | | 4 | 4 | 2 | 25 | 100 | 100 | 40 | 3 |
| **5** | 5F6310 | Chemical Recovery And Technical Analysis Laboratory | **CR & TA Lab** | | | 4 | 4 | 2 | 25 | 100 | 100 | 40 | 3 |
| **6** | 5F6311 | Project Work | **PW** | | | 6 | 6 | 3 | 25 | 100 | 100 | 50 | 3 |
| **7** | 5F6312 | Process Design & Simulation Practical | **PD & S** | | | 4 | 4 | 2 | 25 | 100 | 100 | 50 | 3 |
| | | | | **14** | | **18** | **32** | **23** | | | | | |
| | | Physical Education | **P.Ed** | | | | **2** | | | | | | |
| | | Library | **Lib** | | | | **1** | **23** | | | | | |
| | **TOTAL** | | | | | | **35** | | | | | | |

***External Marks are conducted for 100 Marks and converted to 75 Marks**
**Abbr- ABBRIVATION TH –THEORY TU – TUTORIAL P – PRACTICAL C – CREDIT**

# VII TERM

| Sl. No | Course Code | Course | Abbr | Hours Per Week | | | | | Scheme of Examination | | | Minimum mark For Pass | Duration Of Exam (Hours) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | TH | TU | P | Total Hours | C | Internal | External* | Total | | |
| **1** | 5F7312 | Control Laboratory Utilities and Instrumentation | **CLUI** | | | 24 | 24 | 12 | 25 | 100 | 100 | 50 | 3 |
| **2** | 5F7313 | Paper Making Operation and Mechanical Maintenance | **PMOMM** | | | 24 | 24 | 12 | 25 | 100 | 100 | 50 | 3 |
| | **TOTAL** | | | | | **48** | **48** | **24** | | | | | |

***External Marks are conducted for 100 Marks and converted to 75 Marks**
**Abbr- ABBRIVATION TH –THEORY TU – TUTORIAL P – PRACTICAL C – CREDIT**

**DIPLOMA IN PAPER TECHNOLOGY – E SCHEME**
**COMPARISION BETWEEN "E" SCHEME AND "F" SCHEME**

| THIRD TERM | | | | | |
|---|---|---|---|---|---|
| **SL.NO** | **E SCHEME** | **T/P** | **F SCHEME** | **T/P** | **REMARKS** |
| 1 | Industrial Chemistry | **T** | Industrial Chemistry | **T** | same as E SCHEME |
| 2 | Basis Of Mechanical Engineering & Fluid Mechanics | **T** | Basic's Of Mechanical Engineering | **T** | same as E SCHEME |
| 3 | Pulp And Paper Technology – I | **T** | Pulp & Paper Technology I | **T** | same as E SCHEME |
| 4 | Electrical & Electronics Engineering | **T** | Electrical & Electronics Engineering | **T** | same as E SCHEME |
| 5 | | | Plant Engineering Management & Environmental Engineering | **T** | Shifted from VI Term to III Term |
| 6 | Fluid Mechanics Laboratory | **P** | General Engineering practical | **P** | Fluid Mechanics Laboratory & Electrical & Electronics Engineering Lab are merged |
| | Electrical & Electronics Engineering Lab | **P** | | | |
| 7 | Pulp Technology Laboratory | **P** | Pulp Technology Laboratory | **P** | same as E SCHEME |
| | **NEW SUBJECT INTRODUCED** | | | | |
| 8 | | | Physical Education | | NIL |
| 9 | | | Library | | NIL |

| FOURTH TERM | | | | | |
|---|---|---|---|---|---|
| **SL.NO** | **E SCHEME** | **T/P** | **F SCHEME** | **T/P** | **REMARKS** |
| 1 | Pulping Operation Electrical and Mechanical Maintenance | **P** | Pulping Operation Electrical and Mechanical Maintenance | **P** | same as E SCHEME |
| 2 | Chemical Recovery Operation and Maintenance | **P** | Chemical Recovery Operation and Maintenance | **P** | same as E SCHEME |
| **NEW SUBJECT INTRODUCED** | | | | | |
| 3 | | | Concurrent career Development | **T** | |

| FIFTH TERM | | | | | |
|---|---|---|---|---|---|
| **SL.NO** | **E SCHEME** | **T/P** | **F SCHEME** | **T/P** | **REMARKS** |
| 1 | Process instrumentation and control | **T** | Process Instrumentation And Control | **T** | same as E SCHEME |
| | Plant Engineering Management | **T** | | | Shifted to III term from IV term |
| 2 | Pulp and Paper Technology-II | **T** | Pulp And Paper Technology II | **T** | Not Equivalent |
| 3 | Unit operations | **T** | Unit Operations | **T** | Not Equivalent |
| 4 | Process Instrumentation And Control Laboratory | **P** | Process instrumentation and control Lab | **P** | same as E SCHEME |
| | Life And Employability Skills | **P** | | | Removed |
| 5 | | | Environmental Engineering Laboratory | **P** | Shifted from VI Term to V Term |
| 6 | Unit Operations Laboratory | **P** | Unit Operations Laboratory | **P** | same as E SCHEME |
| | **NEW SUBJECT INTRODUCED** | | | | |
| 7 | | | Universal Human Values | **T** | |
| | | | Entrepreneurship and Startups | **P** | |
| 8 | | | Physical Education | | |
| 9 | | | Library | | |

| SIXTH TERM | | | | | |
|---|---|---|---|---|---|
| **SL.NO** | **E SCHEME** | **T/P** | **F SCHEME** | **T/P** | **REMARKS** |
| 1 | Chemical Recovery | **T** | Chemical Recovery | **T** | same as E SCHEME |
| 2 | Pulp and Paper Technology-III | **T** | Pulp And Paper Technology III | **T** | same as E SCHEME |
| 3 | Process Equipment Design and Environmental Engineering | **T** | Process Design Concept | **T** | Not Equivalent |
| 4 | Paper Technology Laboratory | **P** | Paper Technology Laboratory | **P** | same as E SCHEME |
| | Environmental Engineering Laboratory | **P** | | | Shifted to V Term from VI Term |
| 5 | Chemical Recovery And Technical Analysis Laboratory | **P** | Chemical Recovery And Technical Analysis Laboratory | **P** | same as E SCHEME |
| 6 | Project Work & Entrepreneurship Management | **P** | Project Work | **P** | same as E SCHEME |
| **NEW SUBJECT INTRODUCED** | | | | | |
| 7 | | | Process Design & Simulation Practical | **P** | |
| | | | Physical Education | | |
| | | | Library | | |

| SEVENTH TERM | | | | | |
|---|---|---|---|---|---|
| **SL.NO** | **E SCHEME** | **T/P** | **F SCHEME** | **T/P** | **REMARKS** |
| 1 | Control Laboratory Utilities and Instrumentation | **P** | Control Laboratory Utilities and Instrumentation | **P** | same as E SCHEME |
| 2 | Paper Making operation and Mechanical Maintenance | **P** | Paper Making operation and Mechanical Maintenance | **P** | same as E SCHEME |
| **NEW SUBJECT INTRODUCED** | | | | | |
| | NIL | | NIL | | NIL |

| SL. NO. | SUBJECTS | DISTRIBUTION IN HOURS IN VARIOUS SEMESTERS | | | | |
|---|---|---|---|---|---|---|
| | | III | IV | V | VI | VII |
| 1 | Industrial Chemistry | 5 | | | | |
| 2 | Basic's Of Mechanical Engineering | 5 | | | | |
| 3 | Pulp & Paper Technology I | 5 | | | | |
| 4 | Electrical & Electronics Engineering | 5 | | | | |
| 5 | Plant Engineering Management & Environmental Engineering | 4 | | | | |
| 6 | Pulp Technology Laboratory | 4 | | | | |
| 7 | General Engineering practical | 4 | | | | |
| 8 | Physical Education | 2 | | | | |
| 9 | Library | 1 | | | | |
| 10 | Pulping Operation Electrical and Mechanical Maintenance | | 24 | | | |
| 11 | Chemical Recovery Operation and Maintenance | | 24 | | | |
| 12 | Concurrent career Development* | | 5 | | | |
| 13 | Pulp And Paper Technology II | | | 6 | | |
| 14 | Unit Operations | | | 5 | | |
| 15 | Process Instrumentation And Control | | | 5 | | |
| 16 | Entrepreneurship and Startups | | | 4 | | |
| 17 | Unit Operations Laboratory | | | 4 | | |
| 18 | Environmental Engineering Laboratory | | | 4 | | |
| 19 | Process Instrumentation And Control Laboratory | | | 4 | | |
| 20 | Physical Education | | | 2 | | |
| 21 | Library | | | 1 | | |
| 22 | Universal Human Values* | | | 3 | | |
| 23 | Chemical Recovery | | | | 5 | |
| 24 | Pulp And Paper Technology III | | | | 5 | |
| 25 | Process Design Concept | | | | 4 | |
| 26 | Paper Technology Laboratory | | | | 4 | |
| 27 | Chemical Recovery And Technical Analysis Laboratory | | | | 4 | |
| 28 | Project Work | | | | 6 | |
| 29 | Process Design & Simulation Practical | | | | 4 | |
| 30 | Physical Education | | | | 2 | |
| 31 | Library | | | | 1 | |
| 32 | Control Laboratory Utilities and Instrumentation | | | | | 24 |
| 33 | Paper Making Operation and Mechanical Maintenance | | | | | 24 |
| **TOTAL** | | **35** | **53** | **38** | **35** | **48** |

# DETAILED CONTENTS OF VARIOUS SUBJECTS

## 5F3204 - INDUSTRIAL CHEMISTRY

Programme Name : 5F- 3204-DIPLOMA IN PAPER TECHNOLOGY
Course Code : 5F3204
Term : III
Course Name : INDUSTRIAL CHEMISTRY

### TEACHING AND SCHEME OF EXAMINATION

No of weeks per semester: 16 weeks

| Course | Instructions | | Examination | | | |
|---|---|---|---|---|---|---|
| | Hours / Week | Hours / Term | Marks | | | Duration |
| | | | Internal Assessment | Autonomous Examination | Total | |
| INDUSTRIAL CHEMISTRY | 5 | 80 | 25 | 100* | 100 | 3 Hrs. |

*** Examinations will be conducted for 100 marks and it will be reduced to 75 marks.**

### Topics and Allocation of Hours

| UNIT | Topic | Hrs. |
|---|---|---|
| I | Carbohydrates & cellulose chemistry | 15 |
| II | Manufacturing of chemical additives for Paper Industry & Polymer Industry | 14 |
| III | Dyes | 15 |
| IV | Structure & Reaction of Lignin | 14 |
| V | Basics of Fattyacids, Formaldehyde & Pigments | 15 |
| Test & Model Exam | | 7 |
| **Total** | | 80 |

**RATIONALE:**

Study of industrial chemistry is an essential part in study of pulp and paper technology. The subject forms the foundation of pulp and paper technology. It prepares the students to familiarize with basic concepts and principles of industrial chemistry. Study of industrial chemistry constitutes the basic and fundamental aspect of deriving insight into the functioning and analysis of industrial chemistry, instruments and machineries.

**OBJECTIVES:**

On completion of the course the students will be able

- To learn about the structure and chemistry of carbohydrate, cellulose and lignin.
- To know about the different methods of manufacturing of chlorine, caustic soda, alum andchlorine-di-oxide and its uses.
- To know about the different types of dyes and their multiple uses.
- To know about the methods of preparation, properties and uses of fatty acids and formaldehyde.
- To learn about the different type of pigments, their properties and uses.

## Course Outcome

***On successful completion of the course, the students will be able to attain below Course Outcome (CO):***

| Course outcome | | BTL |
|---|---|---|
| **CO1** | Able to understand the classification of carbohydrates & structure of starch and cellulose. | **U** |
| **CO2** | Able to understand the manufacturing methods of chemical additives used in paper industry. | **U** |
| **CO3** | Able to identify the types of dyes and to understand the applications of various dyes. | **U** |
| **CO4** | Able to interpret the structure &reactions of lignin | **U** |
| **CO5** | Able to explain the preparation & properties of fatty acids, Formaldehyde | **U** |

**Legends:** R = Remember U= Understand; A= Apply and above levels (BTL-Bloom's revised taxonomy Level)

**Course-PO Attainment Matrix**

| CO | Program Outcomes (PO) | | | | | | | Program Specific Outcomes (PSO) | |
|---|---|---|---|---|---|---|---|---|---|
| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PSO1 | PSO2 |
| CO1 | | | | | | | | | |
| CO2 | | | | | | | | | |
| CO3 | | | | | | | | | |
| CO4 | | | | | | | | | |
| CO5 | | | | | | | | | |
| TOTAL | | | | | | | | | |
| No. of COs Mapping with POs | | | | | | | | | |
| Average | | | | | | | | | |
| Round off(Average) | | | | | | | | | |
| Correlation | | | | | | | | | |
| Strong – S / 3 | | | Medium – M /2 | | | | Weak – W / 1 | | |

*Method is to relate the level of PO with the number of hours devoted to the COs which address the given PO.*

- If ≥40% of classroom sessions addressing a particular PO, it is considered that PO is addressed at Level 3
- If 25 to 40% of classroom sessions addressing a particular PO, it is considered that PO is addressed at Level 2
- If 5 to 25% of classroom sessions addressing a particular PO, it is considered that PO is addressed at Level 1
- If < 5% of classroom sessions addressing a particular PO, it is considered that PO is considered not-addressed.

## DETAILED SYLLABUS

Contents: Theory

| Unit | Name of the Topics | Hours |
|---|---|---|
| I | **CARBOHYDRATES & CELLULOSE CHEMISTRY**<br>**Chapter 1.1 – Carbohydrates**<br>Definition-Nomenclature–Classification–Monosaccharides, Disaccharides &Polysaccharides.<br>**Chapter 1.2 -Starch** Starch and its two fractions –Alpha amylose and Beta amylose - A short note on their separation – Their solubility in water and their reaction with iodine only – applications of starch – Native starch, oxidised starch, cationic starch – preparation – properties & applications – integrated & non integrated process (R8).<br>**Chapter 1.3 – Cellulose**<br>Chemical structure of Cellulose – Reason for Fibrous structure – Sorptive property – Swelling property – Degradation reaction with alkali (peeling off reaction) and decomposition reaction with chlorine & Chlorine dioxide. | 15 |
| II | **MANUFACTURING OF CHEMICAL ADDITIVES FOR PAPER INDUSTRY & POLYMER INDUSTRY**<br>**Chapter 2.1 –** Chemical additives used in industry- Manufacture of Chlorine and caustic soda by Mercury cell method and Membrane cell method– simple description with diagrams.<br>**Chapter 2.2 –** Manufacture of chlorine dioxide and oxygen- physical and chemical properties of chlorine, chlorine dioxide and oxygen –Uses of chlorine, Chlorine dioxide and Oxygen with respect to a paper mill.<br>**Chapter 2.3 –** Chemical formula –Manufacturing method of alum from bauxite ore—General uses –Papermakers alum and the effect of impurities such as Ferric salts – Manufacture of PAC and its uses.<br>**Chapter 2.4 -** Definition of polymerization- degree of polymerization – Types<br>of polymerisation-General principles of addition and condensation polymerization reaction – Some common examples for each. | 14 |
| III | **DYES**<br>**Chapter 3.1 –** Definition-Characteristics-Relationship between color and constitution–The concept of auxochrome and chromophore – Classification according to application–Acid dyes, Direct dyes, Basic dyes, Pigment dyes –One example for each. | 15 |

| | | |
|---|---|---|
| **IV** | **STRUCTURE & REACTION OF LIGNIN**<br>**Chapter 4.1 –** Elementary composition–Functional groups– Structure of lignin fragments. Cellulose & lignin comparison.<br>**Chapter 4.2 –** Sulphonation – Mercaptation– Condensation-Oxidation reaction such as Hypochlorite Oxidation, Chlorite Oxidation, peroxide<br>Oxidation and permanganate Oxidation–Halogenation. Short notes on uses of polymeric products from lignin in various fields. | 14 |
| **V** | **BASICS OF FATTY ACIDS, FORMALDEHYDE & PIGMENTS**<br>**Chapter 5.1 – Fatty Acids**<br>**Nomenclature**<br>General methods of preparation by<br>(i) Oxidation of carbonyl compounds<br>(ii) Hydrolysis of cyanides<br>(iii) Using Grignard reagent (Reaction with dicarboxylicacids)<br>**General Chemical Reaction**<br>(i) Alkylgroup (Halogenationandoxidation)<br>(ii) Carboxyl group (1.Withalkalis,withmetals, with alcohols with phosphorus halides and dehydration only)<br>**Chapter 5.2 –Formaldehyde**<br>Industrial preparation – Physical properties – Chemical properties involving reactions with ammonia (urotropine), with sodium hydroxide (cannizzaro reaction) and with alcohols (methyl formation)–Polymers of formaldehyde– Bakelite formation with phenol–Uses of formaldehyde.<br>**Chapter 5.3 – Pigments**<br>Definition-Characteristics- chemical properties and pigmentary properties of titanium calcium pigments, potassium titanate pigment, Hydrated silica only – Uses of pigments. | 15 |

**Reference Books**


1 Text Book Organic Chemistry - Vol I & II, I.L. Finar, Prentice Hall India

2 Pulp & paper science and Technology – Vol .I, Casey J.P. , Academic Press

3 Hand Book of pulp & paper Technology, Kenneth W.Britt, CBS Pubishers

4 Text Book of Organic chemistry (For B.Sc. Degree) , Bahiand Tuli, Prentice Hall India

5 Text book of organic chemistry, P.L.Soni, Sultan Chand & sons

**OUTCOMES after the Completion of the Course:**

**Course Delivery**

The course will be delivered through lectures and Power point presentations/ Video

**Course Assessment and Evaluation Scheme**

| Method | What | To whom | When/Where (Frequency in the course) | Max Marks | Evidence collected | Course outcomes |
|---|---|---|---|---|---|---|
| Direct Assessment | CAT | Students | Three CAT tests (Average of three tests will be computed) | 20 | CAT Answer Scripts | 1 to 5 |
| | | | Student activities | 05 | Activity Reports | 1 to 5 |
| | | | **Total** | **25** | | |
| | End Exam | | **End of the course** | **100** | Answer scripts at AE | 1 to 5 |
| Indirect Assessment | Student Feedback on course | | Middle of the course | | Feedback forms | 1,2,3 Delivery of course |
| | End of Course Survey | | End of the course | | Questionnaires | 1 to 6 Effectiveness of Delivery of instructions & Assessment Methods |

**Note:** Internal Assessment (CAT) test shall be conducted for 50 marks. Average marks of three tests shall be rounded off to the next higher digit.

**Questions for CAT and AE will be designed to evaluate the various educational components (Bloom's taxonomy) such as:**

| Sl. | Bloom's Category | % |
|---|---|---|
| 1 | Remembrance | |
| 2 | Understanding | |
| 3 | Application | |

***Note to Internal Assessment verifier***: ***The following documents to be verified by CIE verifier at the end of semester***

1. CAT Answer Scripts (20 marks)
2. Student suggested activities(assignments) report for 5 marks
3. Student feedback on course regarding Effectiveness of Delivery of instructions & Assessment Methods.

**Autonomous Examination-Question Paper Pattern**

Time: 3 Hrs.

Max.Marks:100

## Model question paper
## YEAR/SEM : II/III MAX MARKS: 100
## Part A

| Q. No | Answer the 10 questions out of the 15 questions. All questions carry equal marks (10x3=30) | UNIT | Bloom's level |
|---|---|---|---|
| 1. | Define carbohydrates and mention their types. | 1 | R |
| 2. | How starch reacts with iodine? Write the reaction. | 1 | U |
| 3. | Give the reasons for the fibrous structure of cellulose. | 1 | U |
| 4. | What is paper maker's alum? Mention its significance. | 2 | U |
| 5. | What is meant by degree of polymerization? | 2 | R |
| 6. | Write the chemical properties of chlorine dioxide. | 2 | U |
| 7. | Mention the characteristics of dyes. | 3 | U |
| 8. | Mention the applications of direct dyes. | 3 | An |
| 9. | What are vat dyes? Give examples. | 3 | R |
| 10. | What is mercarptation? | 4 | U |
| 11. | List the functional groups in lignin. | 4 | R |
| 12. | What is meant by hydrolysis of cyanides? | 4 | U |
| 13. | Write the chemical reaction of bakellite formation with Phenol. | 5 | U |
| 14. | Write the uses of formaldehyde. | 5 | R |
| 15. | State the term pigments with their types and example. | 5 | U |

## PART –B

| Q. No | | Answer all the questions choosing either sub division(A) or subdivision (B) of each questions. All questions carry equal marks (5x14=70) | | | Bloom 's level |
|---|---|---|---|---|---|
| 16 | A. 1 | Explain in detail about the nomenclature of carbohydrates. | 1 | 8 | (R) |
| | A. 2 | Briefly write about starch and its two fractions. | 1 | 6 | (U) |
| | | (Or) | | | |
| | B. 1 | Describe about degradation reaction of cellulose with alkali and decomposition reaction of cellulose with chlorine dioxide. | 1 | 8 | (U) |
| | B. 2 | Explain in detail about the integrated and non-integrated process. | 1 | 6 | (R) |
| 17 | A. 1 | Explain about the manufacture of chlorine and caustic soda by mercury cell method. | 2 | 8 | (U) |
| | A. 2 | How oxygen is prepared? Mention its properties and uses. | 2 | 6 | (R) |
| | | (Or) | | | |
| | B. 1 | Write the difference between addition and condensation polymerization. | 2 | 8 | (U) |
| | B. 2 | Write a short note on manufacture of PAC and its uses. | 2 | 6 | (U) |
| 18 | A. 1 | Write in detail about the colour and constitution of dyes. | 3 | 8 | (U) |
| | A. 2 | Explain about the concept of chromophore and auxochrome with example. | 3 | 6 | (R) |
| | | (Or) | | | |
| | B. 1 | Write briefly about pigment dyes with example. | 3 | 8 | (U) |
| | B. 2 | Write in detail about acidic and basic dyes with example. | 3 | 6 | (R) |
| 19 | A. 1 | Compare cellulose with lignin. | 4 | 8 | (U) |
| | A. 2 | Write a short note on the following:<br>i) Suphonation of lignin ii) Permanganate oxidation | 4 | 6 | (R) |
| | | (Or) | | | |
| | B. 1 | Briefly explain about the uses of polymeric products from lignin in various fields. | 4 | 8 | (R) |
| | B. 2 | Write about Peroxide oxidation and permanganate oxidation with reactions. | 4 | 6 | (U) |

| | | | | | |
|---|---|---|---|---|---|
| **20** | A. 1 | Explain the reaction of carboxylic acid with Grignard reagent with equation. | 5 | 8 | (U) |
| | A. 2 | Write about urotropine reaction and Cannizaro reaction with equation. | 5 | 6 | (U) |
| | | (Or) | | | |
| | B. 1 | Describe about chemical and pigmentary properties of titanium calcium pigments. | 5 | 8 | (R) |
| | B. 2 | Explain about the industrial preparation of formaldehyde. | 5 | 6 | (U) |

Note: Board Examinations will be conducted for 100 Marks and converted to 75 Marks.

## 5F3205 - BASIC'S OF MECHANICAL ENGINEERING

Programme Name : 5F3205 - DIPLOMA IN PAPER TECHNOLOGY
Course Code : 5F3205
Term : III
Course Name : BASIS OF MECHANICAL ENGINEERING

### TEACHING AND SCHEME OF EXAMINATION

No of weeks per semester: 16 weeks

| Course | Instructions | | Examination | | | |
|---|---|---|---|---|---|---|
| | Hours / Week | Hours / Term | Marks | | | Duration |
| | | | Internal Assessment | Autonomous Examination | Total | |
| BASIS OF MECHANICAL ENGINEERING | 5 | 80 | 25 | 100* | 100 | 3 Hrs. |

*** Examinations will be conducted for 100 marks and it will be reduced to 75 marks.**

### Topics and Allocation of Hours

| UNIT | Topic | Hrs. |
|---|---|---|
| I | Properties of materials & Fluid moving machinery used in industry | 15 |
| II | Bearings & Transmission of motion | 14 |
| III | Fluid Statics & Fluid Dynamics | 15 |
| IV | Thermodynamics, Fuels and combustion | 14 |
| V | Steam Boilers & Steam Turbines | 15 |
| Test & Model Exam | | 7 |
| **Total** | | 80 |

**RATIONALE:**

A diploma holder has to assist in activities of installation, operation and maintenance etc of different machines and equipment. The subject of General engineering has been included to impart basic knowledge of fluid is very essential because all paper plants have fluid flow. The examples are flow of stream and gases in pipes, flow of liquid in pipes and open channels etc. This subject aims at the basic concepts of fluid flow, measurement techniques involved for the same and equipments used for the transportation of fluids. With this background, students will be able to quantitatively find out material and power requirement for a process.

**OBJECTIVES:**

At the end of this course, students must be able to know about

- The basic mechanical properties of metal and different kind of stress and strain
- Different types of springs, bearings and different types of drives,
- The basic properties of fluids
- Characteristics of the fluid at static and dynamic conditions
- Bernoulli's equation and its application in fluid flow
- Distinguish between laminar flow and turbulent flow
- Different types of friction occurring due to fluid flow.
- Different types of valves and their specific applications.
- Different types of pumps used for transportation of liquids and their method construction and working principle
- Specific fields of application of pumps
- Performance characteristics of centrifugal and reciprocating pumps
- Know the basics of energy production from boilers
- Able to understand the properties of Thermodynamics
- Know the applications of fuels.

## Course Outcome

***On successful completion of the course, the students will be able to attain below Course Outcome (CO):***

| Course outcome | | BTL |
|---|---|---|
| **CO1** | Able to understand the basic properties of materials & fluid moving machineries used in industries | **R** |
| **CO2** | Able to differentiate Bearings & types of the transmission of motion | **A** |
| **CO3** | Can understand the basic properties of fluids, Fluid statics & Fluid dynamics | **A** |
| **CO4** | Able to understand the basic thermodynamic properties & combustion of fuels | **A** |
| **CO5** | Understand the construction & working of steam boilers & turbines | **U** |

**Legends:** R = Remember U= Understand; A= Apply and above levels (BTL-Bloom's revised taxonomy Level)

**Course-PO Attainment Matrix**

| CO | Program Outcomes (PO) | | | | | | | Program Specific Outcomes (PSO) | |
|---|---|---|---|---|---|---|---|---|---|
| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PSO1 | PSO2 |
| CO1 | | | | | | | | | |
| CO2 | | | | | | | | | |
| CO3 | | | | | | | | | |
| CO4 | | | | | | | | | |
| CO5 | | | | | | | | | |
| TOTAL | | | | | | | | | |
| No. of COs Mapping with POs | | | | | | | | | |
| Average | | | | | | | | | |
| Round off(Average) | | | | | | | | | |
| Correlation | | | | | | | | | |
| Strong – S / 3 | | | Medium – M /2 | | | | Weak – W / 1 | | |

*Method is to relate the level of PO with the number of hours devoted to the COs which address the given PO.*

- If ≥40% of classroom sessions addressing a particular PO, it is considered that PO is addressed at Level 3
- If 25 to 40% of classroom sessions addressing a particular PO, it is considered that PO is addressed at Level 2
- If 5 to 25% of classroom sessions addressing a particular PO, it is considered that PO is addressed at Level 1
- If < 5% of classroom sessions addressing a particular PO, it is considered that PO is considered not-addressed.

## DETAILED SYLLABUS

Contents: Theory

| Unit | Name of the Topics | Time |
|---|---|---|
| I | **Properties of materials & Fluid moving machinery used in industry**<br>**Chapter 1.1 -** Definition of Elasticity – Plasticity – Ductility – Malleability –Toughness- Hardness –Stiffness, Tensile, Compressive and Shear Stress , Hooke's law, Stress strain curve,<br>**Chapter 1.2 - Fluid moving machinery:** Valves & Types - Gate valve, Globe valve and Check valves - Fans, Blowers, Compressors & Pumps - Construction and working of Reciprocating pumps – Screw pump – External and internal Gear pump – Diaphragm pump – centrifugal pump – Multistage centrifuge pumps- self priming pumps – Water Ring pumps. | 15 |
| II | **Bearings & Transmission of motion**<br>**Chapter 2.1 -** Bearing– Types – Journal – Ball – Roller – Tapper Roller – Needle Bearings –Comparison of Journal And Ball Bearings – Linear Motion Bearings & Applications – Lubricant – Types – Solid, Semisolid And Liquid Lubricants - Properties Of Lubricants.<br>**Chapter 2.2 -** Drives – Types – Belt, Chain, Gear Drives – Applications – Merits And Demerits. Cams & followers | 14 |
| III | **Fluid Statics & Fluid Dynamics**<br>**Chapter 3.1 -** Definitions of Compressible and incompressible fluids– Newtonian and non Newtonian fluids– Properties of fluids – Density, specific gravity, specific weight, viscosity, surface tension, capillarity – Turbulent flow – laminar flow – Boundary layer formation.<br>**Chapter 3.2 -** Manometers – U- tube, single column manometers inclined tube manometers – Simple numerical on simple U tube & differential U tube manometers<br>**Chapter 3.3 - Fluid Dynamics:** Continuity equation –Bernoulli's equation – Application of Bernoulli's Theorem | 15 |

| | | |
|---|---|---|
| **IV** | **Thermodynamics, Fuels and combustion**<br>**Chapter 4.1 -** Terminologies in Thermodynamics (definition only) - System and surroundings- open system, closed system, and isolated system- Thermodynamic equilibrium – Laws of Thermodynamics – First law – Second law – Zeroth law<br>**Chapter 4.2 -** Classification of fuels– Solid, liquid and gaseous fuels - merits and demerits – Fossil fuels and non-fossil fuels – Requirements of a good fuel – combustion of fuels– Excess air - products of combustion – Calorific value of fuels (definition only) – LCV and HCV – Orsat analysis for flue gas analysis. | 14 |
| **V** | **STEAM BOILERS & STEAM TURBINES**<br>**Chapter 5.1 -** Properties of steam (Sensible, Latent heat & Dryness fraction) - Classification of boiler – Working principles of high pressure boiler–advantages of high pressure boilers –- Boiler mountings and Accessories – Boiler draught - Safety precaution in boiler operation.<br>**Chapter 5.2 -** Steam turbine – classification -Construction and working of impulse and reaction steam turbines – Advantages & Disadvantages Comparison of impulse and reaction turbines. | 15 |

**Reference Books**


1 Strength of Materials, Ramamirtham, Dhanpatrai&Co

2 Strength of Materials, Bhavilkatti.s, Vikas publication

3 Strength of Materials, Dr. Bansal, Laxmi Publication

4 Theory of Machines, R.SKurmi & J.K Gupta, S. Chand & Company Ltd, New Delhi.

5 Fluid Mechanics & Hydraulic Machines, Ramamirtham, Dhanpatrai&Co

6 Unit operation in chemical Engineering, Warren L Mc abe and jullian D. Smith, McGraw Hill

**Autonomous Examination-Question Paper Pattern**

Time: 3 Hrs.

Max.Marks:100

## Model question paper

## YEAR/SEM : II/III MAX MARKS: 100

## Part A

| Q.no | Answer the 10 questions out of the 15 questions. All questions carry equal marks (10x3=30) | UNIT | Bloom's level |
|---|---|---|---|
| 1. | What is valve? | 1 | (R) |
| 2. | What is priming? | 1 | (R) |
| 3. | List the mechanical properties. | 1 | (R) |
| 4. | What are the types of bearing? | 2 | (R) |
| 5. | What are the properties of lubricant? | 2 | (R) |
| 6. | List the types of belt. | 2 | (R) |
| 7. | Explain capillarity? | 3 | (U) |
| 8. | Define compressible & incompressible fluid. | 3 | (R) |
| 9. | What is manometer? | 3 | (R) |
| 10. | What is a solid fuel? | 4 | (R) |
| 11. | What is calorific value of fuels? | 4 | (R) |
| 12. | Define specific heat capacity at constant pressure. | 4 | (R) |
| 13. | What is sensible heat of water? | 5 | (R) |
| 14. | What is super heated steam? | 5 | (R) |
| 15. | What is nozzle? | 5 | (R) |

## PART –B

| Q.no | | Answer all the questions choosing either sub division(A) or subdivision (B) of each questions. All questions carry equal marks (5x14=70) | | | Bloom's level |
|---|---|---|---|---|---|
| 16 | A. 1 | Explain with neat sketch external gear pump. | 1 | 8 | (U) |
| | A. 2 | Explain gate valve with neat sketch. | 1 | 6 | (U) |
| | | (or) | | | |
| | B. 1 | Explain with neat sketch centrifugal pump | 1 | 8 | (U) |
| | B. 2 | Explain the properties of engineering materials. | 1 | 6 | (U) |
| 17 | A. 1 | Explain with neat sketch taper roller bearing and needle bearing. | 2 | 8 | (U) |
| | A. 2 | Explain types of cam and cam follower with neat sketch. | 2 | 6 | (U) |
| | | (or) | | | |
| | B. 1 | Explain any two types of gear drive with neat sketch. | 2 | 8 | (U) |
| | B. 2 | What are the types of belt and explain any one with a neat sketch. | 2 | 6 | (U) |
| 18 | A. 1 | Describe the laminar and turbulent flow in boundary layer with neat sketch. | 3 | 8 | (U) |
| | A. 2 | Explain the properties of fluids | 3 | 6 | (U) |
| | | (or) | | | |
| | B. 1 | State and prove the Bernoulli's theorem. | 3 | 8 | (R) |
| | B. 2 | Explain the expression of U- tube differential manometer. | 3 | 6 | (U) |
| 19 | A. 1 | Explain zeroth law and first law of thermodynamics. | 4 | 8 | (U) |
| | A. 2 | Explain the analysis of exhaust gas with neat sketch. | 4 | 6 | (U) |
| | | (or) | | | |
| | B. 1 | Explain liquid fuels and gaseous fuels with advantages and disadvantages. | 4 | 8 | (U) |
| | B. 2 | Explain clausis statement. | 4 | 6 | (U) |

| | | | | | |
|---|---|---|---|---|---|
| | A. 1 | Explain BHEL boiler with neat sketch. | 5 | 8 | (U) |
| | A. 2 | Explain impulse turbine with neat sketch. | 5 | 6 | (U) |
| **20** | | (or) | | | |
| | B. 1 | Explain any three boiler mountings with neat sketch. | 5 | 8 | (U) |
| | B. 2 | Explain reaction turbine with neat sketch. | 5 | 6 | (U) |

Note: Board Examinations will be conducted for 100 Marks and converted to 75 Marks.

## 5F3206 - ELECTRICAL & ELECTRONICS ENGINEERING

Programme Name : 5F3206-DIPLOMA IN PAPER TECHNOLOGY.
Course Code : 5F3206
Term : III
Course Name : ELECTRICAL AND ELECTRONICS ENGINEERING

### TEACHING AND SCHEME OF EXAMINATION

No of weeks per semester: 16 weeks

| Course | Instructions | | Examination | | | |
|---|---|---|---|---|---|---|
| | Hours / Week | Hours / Term | Marks | | | Duration |
| | | | Internal Assessment | Autonomous Examination | Total | |
| ELECTRICAL AND ELECTRONICS ENGINEERING | 5 | 80 | 25 | 100* | 100 | 3 Hrs. |

*** Examinations will be conducted for 100 marks and it will be reduced to 75 marks.**

### Topics and Allocation of Hours

| UNIT | Topic | Hrs. |
|---|---|---|
| I | BASIS OF DC AND AC CIRCUITS & BASIC LAWS | 14 |
| II | DC MACHINE & TRANSFORMERS | 15 |
| III | AC MACHINES | 14 |
| IV | ELECTRONIC DEVICES | 15 |
| V | MEASUREING INSRUMENTS & PLC | 15 |
| Test & Model Exam | | 7 |
| **Total** | | 80 |

**RATIONALE:**

The pulp and paper industry depends on electric motors, electronics, instrumentation and control for their day today operation therefore, it sounds better if engineering professional faculty understand the basic of electric and electronics engineering. This subject is aimed at developed the required fundamentals.

**OBJECTIVES:**

On completion of the units of syllabus contents the students will be able to understand

- Fundamental concepts of DC and AC electric circuits
- Basic power system structure and laws
- The construction, working principle and applications of simple DC Generator, DC Motor and Transformer
- The concept of three phase AC system, Rotating Magnetic Field
  The construction, working principle and applications of various AC Machines used in chemical industries such as three phase induction Motor, Alternator, Synchronous Motor and single phase induction Motors.

**Course Outcome**

***On successful completion of the course, the students will be able to attain below Course Outcome (CO):***

| Course outcome | | BTL |
|---|---|---|
| **CO1** | Able to understand the fundamental concepts of DC & AC Circuits | **R** |
| **CO2** | Able to understand the construction and working of DC machine & transformers | **A** |
| **CO3** | Able to understand the construction and working of AC Machines | **A** |
| **CO4** | To understand the fundamental concept of Electronic devices | **A** |
| **CO5** | Able to understand the construction and working of Transducer, CRO & PLC | **U** |

**Legends:** R = Remember U= Understand; A= Apply and above levels (BTL-Bloom's revised taxonomy Level)

**Course-PO Attainment Matrix**

| CO | Program Outcomes (PO) | | | | | | | Program Specific Outcomes (PSO) | |
|---|---|---|---|---|---|---|---|---|---|
| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PSO1 | PSO2 |
| CO1 | | | | | | | | | |
| CO2 | | | | | | | | | |
| CO3 | | | | | | | | | |
| CO4 | | | | | | | | | |
| CO5 | | | | | | | | | |
| TOTAL | | | | | | | | | |
| No. of COs Mapping with POs | | | | | | | | | |
| Average | | | | | | | | | |
| Round off(Average) | | | | | | | | | |
| Correlation | | | | | | | | | |
| Strong – S / 3 | | | Medium – M /2 | | | | Weak – W / 1 | | |

*Method is to relate the level of PO with the number of hours devoted to the COs which address the given PO.*

- If ≥40% of classroom sessions addressing a particular PO, it is considered that PO is addressed at Level 3
- If 25 to 40% of classroom sessions addressing a particular PO, it is considered that PO is addressed at Level 2
- If 5 to 25% of classroom sessions addressing a particular PO, it is considered that PO is addressed at Level 1
- If < 5% of classroom sessions addressing a particular PO, it is considered that PO is considered not-addressed.

## DETAILED SYLLABUS

Contents: Theory

| UNIT | NAME OF THE TOPIC | HOURS |
|---|---|---|
| I | **BASIS OF DC AND AC CIRCUITS & BASIC LAWS**<br>**Chapter: 1.1 Basics Of D.C And A.C Circuits**: Definitions – Voltage, Current, Resistance, Power, Energy and their units. Equivalent resistance of Series, parallel and Series Parallel circuits (Derivation)- simple Problems.<br>**Chapter: 1.2 Basic Laws:** Ohms Law, Kirchoffs laws (Statement & Explanation)<br>**Chapter: 1.3** A.C Circuits –Definition of Inductance, Capacitance, Reactance and Impedance - Basic concept of RL, RC, RLC series circuit.(only theory) .Basic concept of 3 phase supply (only theory)<br>**Chapter: 1.4** Basic Structure of Power Generation, Transmission and Distribution System (elementary treatment only) | 14 |
| II | **DC MACHINE & TRANSFORMERS**<br>**Chapter: 2.1 Magnetism** : Definition of MMF, Flux, Reluctance, Permeability and Flux density and their units. Faradays Laws of Electromagnetic induction, Flemming‟s Left hand and Right hand rule<br>**Chapter: 2.2 Dc Generator:** Parts and Functions of Generator- Working- Types – Applications.<br>**Chapter: 2.3 Dc Motor:** Principle of Working- Back EMF- Types- Uses. Starters- Necessity - Construction and Working of Three Point Starter – Speed control of DC Motors – Armature voltage control and field weakening mode.<br>**Chapter: 2.4 Transformer:** Principle of Working- Construction of Core and Shell type- Transformation Ratio- - Star and Delta types of interconnection in three phase transformer (only illustration) – Uses – Auto Transformer. | 15 |

| | | |
|---|---|---|
| **III** | **AC MACHINES**<br>**Chapter: 3.1 Three Phase Alternator:** Principle of Working – Construction of Salient and Non Salient Pole Rotors- Speed and Frequency relation.<br>**Chapter: 3.2 Synchronous Motor:** Principle of Working – Synchronous speed – Starting -Uses.<br>**Chapter: 3.3 Three Phase Induction Motor:** Principle of Working-Types of Rotors- Slip Ring and Squirrel cage - Slip- Comparison of Slip Ring and Squirrel cage motors- Uses.<br>**Chapter: 3.4 Single Phase Induction Motor:** Construction, Working and Uses of Split Phase Induction Motor- Capacitor Start and Induction Run Motor - Universal Motor – Speed control of AC motors – Pole changing & frequency control (V/F by using power electronic devices) | 14 |
| **IV** | **ELECTRONIC DEVICES**<br>**Chapter: 4.1** Diode –forward biasing and reverse biasing – use of diode in rectifiers – half wave, full wave & Bridge rectifiers – necessity of filters – Regulated power supplies: IC voltage regulators – SMPS, UPS and inverters – General description and their applications<br>**Chapter: 4.2 Display devices** – LED, 7 segment LED, LCD.<br>**Chapter: 4.3 Logic gates**: Positive and negative logic, definition, symbol, truth table, Boolean expression for OR, AND, NOT,NOR,NAND,EXOR and EXNOR gates.<br>**Chapter: 4.4 Microcontroller:** Definition of microcontroller- Block diagram with pin details - uses. | 15 |
| **V** | **MEASUREING INSRUMENTS & PLC**<br>**Chapter:5.1 Instruments:** Construction and Working of PMMC, Dynamometer type Wattmeter & Induction type Energy meter - Megger and it"s uses.<br>**Chapter: 5.2 Electrical Safety:** Importance of earthing - electric shock: first aid, precautions – causes of accident and their preventive measures. Energy conservation: Energy conservation measures in Homes & Industries. Uses of fuses and MCB.<br>**Chapter: 5.3 Cathode Ray Oscilloscope:** Block Diagram and Working of CRO – Diagram of CRT with functions of each parts- Uses.<br>**Chapter: 5.4 Programmable Logic Controllers:** Definition- Block Diagram- Applications | 15 |

**Reference Books**


1. www.allaboutcircuits.com/textbook/direct.../electric-circuits/
2. www.electrical4u.com/battery-history-and-working-principle-of-batteries/


**OUTCOMES for After Completion the Course:**

## Course Delivery

The course will be delivered through lectures and Power point presentations/ Video

## Course Assessment and Evaluation Scheme

| Method | What | To whom | When/Where (Frequency in the course) | Max Marks | Evidence collected | Course outcomes |
|---|---|---|---|---|---|---|
| Direct Assessment | CAT | Students | Three CAT tests (Average of three tests will be computed) | 20 | CAT Answer Scripts | 1 to 5 |
| | | | Student activities | 05 | Activity Reports | 1 to 5 |
| | | | **Total** | **25** | | |
| | End Exam | | **End of the course** | **100** | Answer scripts at AE | 1 to 5 |
| Indirect Assessment | Student Feedback on course | | Middle of the course | | Feedback forms | 1,2,3 Delivery of course |
| | End of Course Survey | | End of the course | | Questionnaires | 1 to 6 Effectiveness of Delivery of instructions & Assessment Methods |

**Note:** Internal Assessment (CAT) test shall be conducted for 50 marks. Average marks of three tests shall be rounded off to the next higher digit.

**Questions for CAT and AE will be designed to evaluate the various educational components (Bloom's taxonomy) such as:**

| Sl. | Bloom's Category | % |
|---|---|---|
| 1 | Remembrance | |
| 2 | Understanding | |
| 3 | Application | |

***Note to Internal Assessment verifier***: ***The following documents to be verified by CIE verifier at the end of semester***

4. CAT Answer Scripts (20 marks)
5. Student suggested activities(assignments) report for 5 marks
6. Student feedback on course regarding Effectiveness of Delivery of instructions & Assessment Methods.

**Autonomous Examination-Question Paper Pattern**

Time: 3 Hrs.

Max.Marks:100

## Model question paper
## YEAR/SEM : II/III MAX MARKS: 100
## Part A

| S.No | Answer the 10 questions out of the 15 questions. All questions carry equal marks (10x3=30) | UNIT | Bloom's level |
|---|---|---|---|
| 1. | State Ohm's law | 1 | R |
| 2. | Define power and energy. | 1 | R |
| 3. | Three resistances are connected in series. Find the total resistance. | 1 | An |
| 4. | Define form factor | 2 | U |
| 5. | Define inductance | 2 | U |
| 6. | What is transformer? | 2 | R |
| 7. | Write and 3 difference between slip ring squirrel cage motor | 3 | R |
| 8. | Write the application of capacitor start induction motor. | 3 | R |
| 9. | What is universal motor? | 3 | U |
| 10. | Explain the types of regulators | 4 | U |
| 11. | Write the advantage and disadvantages of Inverters | 4 | R |
| 12. | Explain De morgan's second law with an example | 4 | Ap |
| 13. | What is important earthing? | 5 | U |
| 14. | What is megger? | 5 | U |
| 15. | Write the application of PLC. | 5 | U |

## PART –B

| S.No | | Answer all the questions choosing either sub division(A) or subdivision (B) of each questionsAll questions carry equal marks (5x14=70) | UNIT | Bloom's level |
|---|---|---|---|---|
| | A. 1 | Briefly explain the types of DC generator. (7) | 1 | U |
| | A. 2 | Derive and expression for 3 resistance are connected in parallel and also find total resistance.(7) | 1 | An |
| 16 | | (OR) | | |
| | B. 1 | State and explain Kirchoff's law (7) | 1 | U |
| | B. 2 | Draw and explain the basic structrue of power generation. (7) | 1 | U |
| | A. 1 | Explain the construction, working principle of transformer with neat sketch(7) | 2 | U |
| | A. 2 | Explain the construction of Dc motor with a neat diagram (7) | 2 | U |
| 17 | | (OR) | | |
| | B. 1 | Explain the working principle of 3 point starter with a neat sketch (7) | 2 | U |
| | B. 2 | n the construction of DC generator.(7) | 2 | U |
| | A. 1 | Explain the construction and working principal of synchronous motor(7) | 3 | U |
| | A. 2 | Explain the construction and working of Capacitor start induction motor.(7) | 3 | U |
| 18 | | (OR) | | |
| | B. 1 | Explain working principle of three phase induction motor.(7) | 3 | U |
| | B. 2 | Explain the working principle of universal motors.(7) | 3 | U |

| | | | | |
|---|---|---|---|---|
| | A. 1 | Explain the working of PN junction diode.(7) | 4 | U |
| | A. 2 | Explain the construction and working LCD(7) | 4 | U |
| 19 | | (OR) | | |
| | B. 1 | Design AND,OR,NOT and EX-OR gate using NOR only(7) | 4 | U |
| | B. 2 | Draw and explain the full wave rectifier.(7) | 4 | U |
| | A. 1 | Explain the working principle of PMMC instruments(7) | 5 | U |
| | A. 2 | What is electric shock? First aid and precautions causes of accident and their preventive measures.(7) | 5 | U |
| 20 | | (OR) | | |
| | B. 1 | Draw and explain block diagram of CRO(7) | 5 | U |
| | B. 2 | Draw and explainblock diagram of PLC (7) | 5 | U |

Note: Board Examinations will be conducted for 100 Marks and converted to 75 Marks.

# 5F3301 - PULP & PAPER TECHNOLOGY I

Programme Name : 5F3301-DIPLOMA IN PAPER TECHNOLOGY
Course Code : 5F3301
Term : III
Course Name : PULP & PAPER TECHNOLOGY – I

## TEACHING AND SCHEME OF EXAMINATION

No of weeks per semester: 16 weeks

| Course | Instructions | | Examination | | | |
|---|---|---|---|---|---|---|
| | Hours / Week | Hours / Term | Marks | | | Duration |
| | | | Internal Assessment | Autonomous Examination | Total | |
| PULP & PAPER TECHNOLOGY – I | 5 | 80 | 25 | 100* | 100 | 3 Hrs. |

*** Examinations will be conducted for 100 marks and it will be reduced to 75 marks.**

## Topics and Allocation of Hours

| UNIT | Topic | Hrs. |
|---|---|---|
| I | History of Paper Making & types of Raw material | 15 |
| II | Processing of wood | 15 |
| III | Non wood plant fibers & Pulping process | 14 |
| IV | Stock preparation & it's equipments | 15 |
| V | Non Fibrous Materials in stock preparation | 14 |
| Test & Model Exam | | 7 |
| **Total** | | 80 |

**RATIONALE**

Students will be given the idea of various processes to convert raw material to pulp. The status of Indian industries in relation to pulp making should be imparted to them. The use of pulp for various types of papermaking should also be emphasized

**OBJECTIVES**

After the completion of this course, the student will be able to know about Classification of fibrous raw material

- Morphological analysis of fiber
- Brief description of cellulose, hemi cellulose, lignin and extractives
- Brief study of debarking types of screens
- How to prepare stock for paper making.
- Different types of Sizing & Dyes.

## Course Outcome

***On successful completion of the course, the students will be able to attain below Course Outcome (CO):***

| Course outcome | | BTL |
|---|---|---|
| **CO1** | Understanding the classification of carbohydrates & cellulose structure | **U** |
| **CO2** | Understanding the manufacturing methods of chemical additives used in paper industry | **U** |
| **CO3** | Able to differentiate & application of various dyes | **A** |
| **CO4** | Understanding the structure & Reaction of lignin | **A** |
| **CO5** | Able to understand the preparation & properties of fatty acids, Formaldehyde | **R** |

**Legends:** R = Remember U= Understand; A= Apply and above levels (BTL-Bloom's revised taxonomy Level)

**Course-PO Attainment Matrix**

| CO | Program Outcomes (PO) | | | | | | | Program Specific Outcomes (PSO) | |
|---|---|---|---|---|---|---|---|---|---|
| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PSO1 | PSO2 |
| CO1 | | | | | | | | | |
| CO2 | | | | | | | | | |
| CO3 | | | | | | | | | |
| CO4 | | | | | | | | | |
| CO5 | | | | | | | | | |
| TOTAL | | | | | | | | | |
| No. of COs Mapping with POs | | | | | | | | | |
| Average | | | | | | | | | |
| Round off(Average) | | | | | | | | | |
| Correlation | | | | | | | | | |
| Strong – S / 3 | | | Medium – M /2 | | | | Weak – W / 1 | | |

*Method is to relate the level of PO with the number of hours devoted to the COs which address the given PO.*

- If ≥40% of classroom sessions addressing a particular PO, it is considered that PO is addressed at Level 3
- If 25 to 40% of classroom sessions addressing a particular PO, it is considered that PO is addressed at Level 2
- If 5 to 25% of classroom sessions addressing a particular PO, it is considered that PO is addressed at Level 1
- If < 5% of classroom sessions addressing a particular PO, it is considered that PO is considered not-addressed.

## DETAILED SYLLABUS

Contents: Theory

| Unit | Name of the Topics | Time |
|---|---|---|
| I | **HISTORY OF PAPER MAKING & TYPES OF RAW MATERIAL**<br>**Chapter 1.1 -** Historical development of pulping and papermaking process. A simple Block diagram outlining the stage of process in integrated pulp and paper industry. Fibrous raw materials – Introduction – Selection Criteria of fibrous raw materials – A note on L/D ratio – Classification of fibrous raw materials including the classification of vegetable fibers with one example for each and a brief description of them – Chemistry of materials with special reference to wood. | 15 |
| II | **PROCESSING OF WOOD**<br>**Chapter 2.1 -** Fiber morphology with a simple sketch and a brief note an cell-walls – A note on Wood procurement, receiving and measurement-Debarking and its importance<br>**Chapter 2.2 -** Acceptable chip size – Rechipper Concept of oven dry and air dry raw materials including simple problems – Difference between hardwood and softwoods – Usage of these woods in different paper making – Wood Pulping line | 15 |
| III | **NON WOOD PLANT FIBERS & PULPING PROCESS**<br>**Chapter 3.1 -** The growth and fiber values of bamboo, bagasse, straws, grasses, jute coir, cotton, Kenaf and Banana– A short note on hemicelluloses in papermaking.<br>**Chapter 3.2 -** General principles of pulping – General classification of pulping processes – principles of mechanical and chemical pulping processes (an introductory treatment only) – Their merits and demerits – An introduction to soda and sulphate processes only – Sulphate process description in detail – RDH – Super Batch pulping process – OCC line | 14 |
| IV | **STOCK PREPARATION & IT'S EQUIPMENTS**<br>**Chapter4.1 -** Introduction – Basic principles of stock preparation systems – The concept of consistency and simple problems on consistency involving stock blending – Important operations of stock preparation – Theory of beating (a description with the sketch of cellulose fiber) – Refinig Vs strength properties – A simple sketch of conical and disc refiners and their functions in brief – Effect of refining on sheet properties<br>**Chapter 4.2 -** White water and its reclamation – Save-all – Cleaning of stock (ahead of paper machine) – Centrifugal separation – Pulpers<br>**Chapter 4.3 -** Introduction and principles – Method of sizing – | 15 |

| | | |
|---|---|---|
| | Factors affecting sizing –Chemistry of sizing process – Alumina Theory and Co-ordinate valences theory – Description of chemicals with reference to rosin, alum, waxes and rosin. Alkaline sizing with ASA – Surface sizing. | |
| **V** | **NON FIBROUS MATERIALS IN STOCK PREPARATION**<br>**Chapter 5.1 -** Principles – Fillers and paper properties- Paper fillers and their brief description – Production of fillers – Retention and effects of fillers – Theories of retention – Two sidedness of paper.<br>**Chapter 5.2 -** Method of adding dyes – Mechanism of paper dyeing – Factors affecting stock dye.<br>**Chapter 5.3 –** Technical calculations for pulp mill – O.D Weight – Tank capacity – Pipe size – Centricleaner calculation Screening calculation – Washing loss & Bleaching Calculation. | 14 |

**Reference Books**


1 Hand book of pulp and paper technology, Kenneth W. Britt, CBS Publishers
2 pulp and paper volume I and II, James P. Casey, Academic Press
3 Pulping process, Sven A. Rydholm, Inter science publisher
4 Pulp and paper Manufacture I and II, Ronald G Macdonald, Wiley & Sons
5 Hand book of paper & Board, Herbert Holik (Editor) , Wiley publishers

**OUTCOMES for After Completion the Course:**

**Course Delivery**

The course will be delivered through lectures and Power point presentations/ Video

**Course Assessment and Evaluation Scheme**

| Method | What | To whom | When/Where (Frequency in the course) | Max Marks | Evidence collected | Course outcomes |
|---|---|---|---|---|---|---|
| Direct Assessment | CAT | Students | Three CAT tests (Average of three tests will be computed) | 20 | CAT Answer Scripts | 1 to 5 |
| | | | Student activities | 05 | Activity Reports | 1 to 5 |
| | | | **Total** | **25** | | |
| | End Exam | | **End of the course** | **100** | Answer scripts at AE | 1 to 5 |
| Indirect Assessment | Student Feedback on course | | Middle of the course | | Feedback forms | 1,2,3 Delivery of course |
| | End of Course Survey | | End of the course | | Questionnaires | 1 to 6 Effectiveness of Delivery of instructions & Assessment Methods |

**Note:** Internal Assessment (CAT) test shall be conducted for 50 marks. Average marks of three tests shall be rounded off to the next higher digit.

**Questions for CAT and AE will be designed to evaluate the various educational components (Bloom's taxonomy) such as:**

| Sl. | Bloom's Category | % |
|---|---|---|
| 1 | Remembrance | |
| 2 | Understanding | |
| 3 | Application | |

***Note to Internal Assessment verifier***: ***The following documents to be verified by CIE verifier at the end of semester***

7. CAT Answer Scripts (20 marks)
8. Student suggested activities(assignments) report for 5 marks
9. Student feedback on course regarding Effectiveness of Delivery of instructions & Assessment Methods.

**Autonomous Examination-Question Paper Pattern**

Time: 3 Hrs.

Max.Marks:100

## Model question paper
## YEAR/SEM : II/III MAX MARKS: 100
## Part A

| Q.No | Answer the 10 questions out of the 15 questions. All questions carry equal marks (10x3=30) | UNIT | Bloom's level |
|---|---|---|---|
| 1. | Mention some fibrous raw material for paper making. | 1 | (R) |
| 2. | Define L/D ratio. | 1 | (R) |
| 3. | Describe about lignin. | 1 | (U) |
| 4. | Define Debarking. | 2 | (R) |
| 5. | Sketch Fiber morphology. | 2 | (R) |
| 6. | Describe about rechipper. | 2 | (U) |
| 7. | Describe the uses of grasses in pulping industry. | 3 | (U) |
| 8. | Describe the principle of pulping. | 3 | (U) |
| 9. | Describe about super batch. | 3 | (U) |
| 10. | Describe the theory of beating. | 4 | (U) |
| 11. | Define refining. | 4 | (R) |
| 12. | Define sizing. | 4 | (R) |
| 13. | Define two sidedness of paper. | 5 | (R) |
| 14. | Define retention | 5 | (R) |
| 15. | Mention some types of dyes employed in paper industry. | 5 | (R) |

## PART –B

| Q. No | | Answer all the questions choosing either sub division(A) or subdivision (B) of each questions. All questions carry equal marks (5x14=70) | | Bloom's level |
|---|---|---|---|---|
| 16 | A. 1 | Write about the classification of fibrous raw materials. | 1 | (U) |
| | A. 2 | Give details about any three fibrous raw materials. | 1 | (U) |
| | | (or) | | |
| | B. 1 | Draw the outline of paper making process from raw material handling. | 1 | (A) |
| | B. 2 | Define H – factor. | 1 | (R) |
| 17 | A. 1 | Explain in detail about the fiber morphology. | 2 | (R) |
| | A. 2 | Mention some methods for debarking. | 2 | (U) |
| | | (or) | | |
| | B. 1 | Differentiate Hardwood and softwood. | 2 | (U) |
| | B. 2 | Mention the usage of Rechipper. | 2 | (U) |
| 18 | A. 1 | Write short notes on Hemicellulose. | 3 | (R) |
| | A. 2 | Write about Bagasse & Bamboo | 3 | (R) |
| | | (or) | | |
| | B. 1 | Mention the classification of Pulping process. | 3 | (U) |
| | B. 2 | Differentiate Mechanical & Chemical pulping process | 3 | (U) |
| 19 | A. 1 | Define refining equipments in detail. | 4 | (R) |
| | A. 2 | Mention some effects of refining on sheet properties. | 4 | (U) |
| | | (or) | | |
| | B. 1 | Write about white water reclamation in Paper machine. | 4 | (R) |
| | B. 2 | Define alkaline sizing. | 4 | (R) |

| | | | | |
|---|---|---|---|---|
| | A. 1 | Write in detail about the fillers and their effects on paper making | 5 | (R) |
| | A. 2 | Define Consistency, Gsm,Gpl. | 5 | (R) |
| 20 | | (or) | | |
| | B. 1 | Write the mechanism involved in dyeing of paper. | 5 | (R) |
| | B. 2 | Mention the factors affecting stock dye. | 5 | (U) |

Note: Board Examinations will be conducted for 100 Marks and converted to 75 Marks.

## 5F3401 - PLANT ENGINEERING MANAGEMENT & ENVIRONMENTAL ENGINEERING

Programme Name : 5F3401 - DIPLOMA IN PAPER TECHNOLOGY
Course Code : 5F3401
Term : III
Course Name : PLANT ENGINEERING MANAGEMENT & ENVIRONMENTAL ENGINEERING

**TEACHING AND SCHEME OF EXAMINATION**

No of weeks per semester: 16 weeks

| Course | Instructions | | Examination | | | |
|---|---|---|---|---|---|---|
| | Hours / Week | Hours / Term | Marks | | | Duration |
| | | | Internal Assessment | Autonomous Examination | Total | |
| PLANT ENGINEERING MANAGEMENT & ENVIRONMENTAL ENGINEERING | 5 | 80 | 25 | 100* | 100 | 3 Hrs. |

*** Examinations will be conducted for 100 marks and it will be reduced to 75 marks.**

**Topics and Allocation of Hours**

| UNIT | Topic | Hrs. |
|---|---|---|
| I | PRINCIPLES OF MANAGEMENT | 15 |
| II | ORGANISATION AND QUALITY CONTROL | 14 |
| III | MARKETING FUNCTIONS, INDUSTRIAL RELATIONS AND SAFETY | 15 |
| IV | AIR POLLUTION & NOISE POLLUTION | 14 |
| V | WATER POLLUTION & LAND POLLUTION | 15 |
| Test & Model Exam | | 7 |
| **Total** | | 80 |

**RATIONALE**

Most of the chemical engineering operations will involve principles of management, organization and quality control marketing function, industrial relations, safety environmental management and disaster management.

**OBJECTIVES**

At the end of this course, students will be able to

- To understand the different types of ownership in industry
- To understand the scientific management
- To organize the different activities of the plant
- To develop the traits required for entrepreneur
- To select the plant location and product
- To acquire better knowledge about decision making and communication
- To understand the important factors of production planning control
- To carryout suitable effective methods for inventory control
- To maintain good quality control
- To understand the various quality certification schemes
- To understand the different marketing techniques
- To promote the products with effective methods
- To select the suitable advertising techniques
- To understand the different factory acts for employee welfare
- To appraise the safety performance
- To understand the importance of pollution control
- To analyze the impact of pollution
- To select the suitable solid waste treatment techniques
- To understand various treatments and disposal methods for waste water
- To choose the suitable air pollution control methods

## Course Outcome

***On successful completion of the course, the students will be able to attain below Course Outcome (CO):***

| Course outcome | | BTL |
|---|---|---|
| **CO1** | Identify the principle of management & plant maintenance | **R** |
| **CO2** | Understand what is planning , arrangement and coordination, quality and how it is maintain in good quality of the product | **A** |
| **CO3** | Understand the marketing and sales of our products and maintain relation between the employer and employee | **A** |
| **CO4** | Know about the standard terms and their controlling methods of Air pollution & Noise pollution | **A** |
| **CO5** | Know about the standard terms and their controlling methods of water pollution & land pollution | **A** |

**Legends:** R = Remember U= Understand; A= Apply and above levels (BTL-Bloom's revised taxonomy Level)

**Course-PO Attainment Matrix**

| CO | Program Outcomes (PO) | | | | | | | Program Specific Outcomes (PSO) | |
|---|---|---|---|---|---|---|---|---|---|
| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PSO1 | PSO2 |
| CO1 | | | | | | | | | |
| CO2 | | | | | | | | | |
| CO3 | | | | | | | | | |
| CO4 | | | | | | | | | |
| CO5 | | | | | | | | | |
| TOTAL | | | | | | | | | |
| No. of COs Mapping with POs | | | | | | | | | |
| Average | | | | | | | | | |
| Round off(Average) | | | | | | | | | |
| Correlation | | | | | | | | | |
| Strong – S / 3 | | | Medium – M /2 | | | | Weak – W / 1 | | |

*Method is to relate the level of PO with the number of hours devoted to the COs which address the given PO.*

- If ≥40% of classroom sessions addressing a particular PO, it is considered that PO is addressed at Level 3
- If 25 to 40% of classroom sessions addressing a particular PO, it is considered that PO is addressed at Level 2
- If 5 to 25% of classroom sessions addressing a particular PO, it is considered that PO is addressed at Level 1
- If < 5% of classroom sessions addressing a particular PO, it is considered that PO is considered not-addressed.

## DETAILED SYLLABUS

Contents: Theory

| Unit | Name of the Topics | Time |
|---|---|---|
| I | **PRINCIPLES OF MANAGEMENT**<br>**Chapter 1.1 -** Role of industry –Types of ownership- Proprietorship, partnership-Private limited –Public limited – Industrial co- operatives<br>**Chapter 1.2 -** Scientific management –Functions of management –Types of organization –line-staff-functional organization – concept and Definition<br>**Chapter 1.3 -** Product selection –Site selection – Principles of plant layout – Factors influencing plant location. | 15 |
| II | **ORGANISATION AND QUALITY CONTROL**<br>**Chapter 2.1 -** Leadership in organization –Decision making – Communication –Motivation –Group dynamics – Production planning and control –Need for planning – Routing –Scheduling – Dispatching<br>**Chapter 2.2 -** PERT –CPM – Inventory control –ABC analysis of safety stock –EOQ method – Purchasing procedures –Records – Bin cards<br>**Chapter 2.3 -** Quality control –Basic concepts –Definition – Terminology – Presentation of data –Indian standards on quality control technique –Quality certification schemes –ISO 9000 etc. | 14 |
| III | **MARKETING FUNCTIONS, INDUSTRIAL RELATIONS AND SAFETY**<br>**Chapter 3.1 -** Marketing –Definition –Information –Functions – Pricing policy –Pricing techniques - Sales –Definition –Personal selling –Promotion mix – Advertising –Sales packaging – Promotion techniques<br>**Chapter 3.2 -** Trade unions –Disputes –Settlement –Collective bargaining –Welfare concepts –Rights and responsibilities of employer and employee –Factories act 1948 –Industrial dispute act 1947 – Trade unions act - 1926 –ESI act 1948 –Child labour act<br>**Chapter 3.3 -** Process safety –Hazard analysis –Risk analysis – Common causes of accidents –Safety training –Electrical hazard – Fire hazard –Explosion hazard –First aid. | 15 |

| | | |
|---|---|---|
| **IV** | **AIR POLLUTION & NOISE POLLUTION**<br>**Chapter 4.1 -** Pollution control Standards for air Sources of air pollution- Effects of air pollution on Environment, materials, human health and animals- Equipments for control of air pollutants as applicable to pulp and paper industries namely Dust collectors, Cyclone separators, Venturi scrubbers and Electrical precipitators<br>**Chapter 4.2 -** Definition of Noise pollution – Sources of noise pollution – Noise control criteria – Noise exposure index – Control of noise pollution – Source of odour as applied to paper mill and its control. Ozone layer depletion, Acid rain , Global warming and Green house gas effect | 14 |
| **V** | **WATER POLLUTION & LAND POLLUTION**<br>**Chapter 5.1 -** Definition of water pollution Sources of water- Hardness of water- raw water clarification Filtration – Water treatment by lime-soda process and ion-exchange process- Ultra filtration and reverse osmosis – pollution control standards for water Sources of water pollution – Their effects on environment and materials – Recycle and reuse – Water conservation methods – BOD and COD – Their measurement.<br>**Chapter 5.2 -** Definition of Land pollution – Sources and classification of solid wastes – Solid wastes generated from various units of paper mill –Their disposal and treatment. | 15 |

**Reference Books**


1 Managing Quality, Dale and pluniket, Wiley - Blackwell
2 Industrial engineering and management, K. Balasundaram, Sri Ramalinga sowdeswari Publication
3 Industrial engineering and management, By O.P. Khanna, Dhanpatrai & Co
4 Pollution control and chemical recovery in pulp and paper industry, H.R.Jones (Noyes data corporation), Pittman publishing Limited
5 Air pollution and industry, R.D. Rose Engg. , Rose Environmental Inc
6 Chem. Tech. Vol I, Edn. Devel I.I.T, IIT Chennai

**OUTCOMES for After Completion the Course:**

**Course Delivery**

The course will be delivered through lectures and Power point presentations/ Video

**Course Assessment and Evaluation Scheme**

| Method | What | To whom | When/Where (Frequency in the course) | Max Marks | Evidence collected | Course outcomes |
|---|---|---|---|---|---|---|
| Direct Assessment | CAT | Students | Three CAT tests (Average of three tests will be computed) | 20 | CAT Answer Scripts | 1 to 5 |
| | | | Student activities | 05 | Activity Reports | 1 to 5 |
| | | | **Total** | **25** | | |
| | End Exam | | **End of the course** | **100** | Answer scripts at AE | 1 to 5 |
| Indirect Assessment | Student Feedback on course | | Middle of the course | | Feedback forms | 1,2,3 Delivery of course |
| | End of Course Survey | | End of the course | | Questionnaires | 1 to 6 Effectiveness of Delivery of instructions & Assessment Methods |

**Note:** Internal Assessment (CAT) test shall be conducted for 50 marks. Average marks of three tests shall be rounded off to the next higher digit.

**Questions for CAT and AE will be designed to evaluate the various educational components (Bloom's taxonomy) such as:**

| Sl. | Bloom's Category | % |
|---|---|---|
| 1 | Remembrance | |
| 2 | Understanding | |
| 3 | Application | |

***Note to Internal Assessment verifier***: ***The following documents to be verified by CIE verifier at the end of semester***

10. CAT Answer Scripts (20 marks)
11. Student suggested activities(assignments) report for 5 marks
12. Student feedback on course regarding Effectiveness of Delivery of instructions & Assessment Methods.

**Autonomous Examination-Question Paper Pattern**

Time: 3 Hrs.

Max.Marks:100

## Model question paper
## YEAR/SEM : II/III MAX MARKS: 100
## Part A

| Q.No | Answer the 10 questions out of the 15 questions. All questions carry equal marks (10x3=30) | UNIT | Bloom's level |
|---|---|---|---|
| 1. | What is the Role of industry | 1 | (R) |
| 2. | How would you classify the type of types of ownerships? | 1 | (U) |
| 3. | List the objectives of Planning. | 1 | (R) |
| 4. | Define the Importance of leadership. | 2 | (R) |
| 5. | Describe Economic Order Quantity. (EOQ). | 2 | (U) |
| 6. | Explain Quality Control. | 2 | (U) |
| 7. | Explain Marketing. | 3 | (U) |
| 8. | Can you list six commonly used advertising media? | 3 | (An) |
| 9. | List some methods for Prevention of Industrial Disputes: | 3 | (R) |
| 10. | Write some source of air pollution | 4 | (U) |
| 11. | Define Noise Pollution | 4 | (R) |
| 12. | Write about global warming | 4 | (U) |
| 13. | Write some sources of water. | 5 | (U) |
| 14. | What is meant by hardness in water | 5 | (R) |
| 15. | List out some sources for Landfills or solid wastes | 5 | (R) |

## PART –B

| Q. No | | Answer all the questions choosing either sub division(A) or subdivision (B) of each questions. All questions carry equal marks (5x14=70) | | | Bloom's level |
|---|---|---|---|---|---|
| 16 | A. 1 | Discuss in detail about the types of ownerships. | 1 | 8 | (An) |
| | A. 2 | Mention the difference between Public & Private limited company. | 1 | 6 | (U) |
| | | (Or) | | | |
| | B. 1 | Write down the factors for site selection? | 1 | 8 | (U) |
| | B. 2 | Write briefly about the Plant layout. | 1 | 6 | (U) |
| 17 | A. 1 | Explain Programme Evaluation And Review Technique (PERT). | 2 | 8 | (U) |
| | A. 2 | Discuss Economic Order Quantity (EOQ). | 2 | 6 | (An) |
| | | (Or) | | | |
| | B. 1 | Discuss about Indian Standards on Quality systems. | 2 | 8 | (An) |
| | B. 2 | Demonstrate Terminology in quality control. | 2 | 6 | (U) |
| 18 | A. 1 | What facts can you compile for Settlement of Industrial Disputes? | 3 | 8 | (C) |
| | A. 2 | Discuss about Right and responsibilities of Employer & Employee. | 3 | 6 | (An) |
| | | (Or) | | | |
| | B. 1 | Summarize Factories Act 1948. | 3 | 8 | (U) |
| | B. 2 | Describe CHILD LABOUR ACT. | 3 | 6 | (U) |

| | | | | | |
|---|---|---|---|---|---|
| | A. 1 | Write in detail about the effects of air pollution | 4 | 8 | (U) |
| | A. 2 | Write about the equipments employed in paper industry for controlling air pollution | 4 | 6 | (U) |
| **19** | | (Or) | | | |
| | B. 1 | Write about Ozone layer depletion, Global warming& Green house effect. | 4 | 8 | (U) |
| | B. 2 | Write in detail about the sources of noise pollution in a paper industry. | 4 | 6 | (U) |

| | | | | | |
|---|---|---|---|---|---|
| | A. 1 | Write in detail about the Ultra filtration and reverse osmosis. | 5 | 8 | (U) |
| | A. 2 | Write in detail about the need of water conservation. | 5 | 6 | (U) |
| **20** | | (Or) | | | |
| | B. 1 | Write in detail about the Solid wastes generated from various units of paper. | 5 | 8 | (U) |
| | B. 2 | Mention some Sources and classification of solid wastes. | 5 | 6 | (R) |

Note: Board Examinations will be conducted for 100 Marks and converted to 75 Marks.

## 5F3207 - GENERAL ENGINEERING PRACTICAL

Programme Name : 5F3207-DIPLOMA IN PAPER TECHNOLOGY
Course Code : 5F3207
Term : III
Course Name : GENERAL ENGINEERING PRACTICAL

### TEACHING AND SCHEME OF EXAMINATION

No of weeks per semester: 16 weeks

| Course | Instructions | | Examination | | | |
|---|---|---|---|---|---|---|
| | Hours / Week | Hours / Term | Marks | | | Duration |
| | | | Internal Assessment | Autonomous Examination | Total | |
| GENERAL ENGINEERING PRACTICAL | 4 | 64 | 25 | 100* | 100 | 3 Hrs. |

*** Examinations will be conducted for 100 marks and it will be reduced to 75 marks.**

**RATIONALE**

The knowledge of fluid flow is very essential because all chemical plants have fluid flow. The examples are flow of stream and gases in pipes, flow of liquid in pipes and open channels etc., this subject aims at the basic concepts of fluid flow, measurement techniques involved for the same and equipments used for the transportation of fluids. With this background, students will be able to quantitatively find out material and power requirement for a process.

**OBJECTIVES**

After the completion of this course, the student should be able to construct and test

- To conduct flow experiments in orifice and venture and to determine the coefficient of discharge.
- Determination of the friction factor in pipe friction experimental setup
- Determination of performance characteristics of a Centrifugal pump and volumetric efficiency of a compressor

**Course Outcomes:**

| Course outcome | | BTL |
|---|---|---|
| **CO1** | Conduct flow experiments and find coefficient of discharge in flow meter & Pipe friction | **A** |
| **CO2** | Determine the performance characteristics of Centrifugal & Reciprocating pump | **A** |
| **CO3** | Determine the performance characteristics & volumetric efficiency of a compressor | **A** |
| **CO4** | Measure the load on given single phase transformer & single phase induction motor | **A** |
| **CO5** | Understand the characteristics of PN junction diode, Transistor, Photo diode & thermistor | **A** |

**Mapping Course Outcomes (CO) - Program Outcomes (PO)**

| CO | Program Outcomes (PO) | | | | | | | Program Specific Outcomes (PSO) | |
|---|---|---|---|---|---|---|---|---|---|
| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PSO1 | PSO2 |
| CO1 | | | | | | | | | |
| CO2 | | | | | | | | | |
| CO3 | | | | | | | | | |
| CO4 | | | | | | | | | |
| CO5 | | | | | | | | | |
| TOTAL | | | | | | | | | |
| No. of COs Mapping with POs | | | | | | | | | |
| Average | | | | | | | | | |
| Round off(Average) | | | | | | | | | |
| Correlation | | | | | | | | | |
| Strong – S / 3 | | | Medium – M /2 | | | | Weak – W / 1 | | |

## DETAILED SYLLABUS

Contents: Practical

**Name of the Topics:**

**Exercise**

1. Determination of Orifice Co-Efficient.
2. Determination of Venturi Co-Efficient.
3. Determination of Pipe Friction
4. Compressor Test Rig.
5. Centrifugal Pump Characteristics
6. Reciprocating Pump Characteristics
7. Determination of Unknown Resistance by ohms law
8. Power measurement in a single phase circuit.
9. Load test on a single phase transformer
10. Characteristics of PN Junction Diode
11. Construction of Bridge Rectifier
12. Verification of Logic Gates

**Experiment Plan:**

| Module No. | Week No. | Experiments Name | Course Outcome | Weightage |
|---|---|---|---|---|
| 1. | 3 | Determination of Orifice Co-Efficient. | | |
| 2. | 5 | Determination of Venturi Co-Efficient. | | |
| 3. | 7 | Determination of Pipe Friction | | |
| 4. | 9 | Compressor Test Rig. | | |
| 5. | 11 | Centrifugal Pump Characteristics | | |
| 6. | 13 | Reciprocating Pump Characteristics | | |
| 7. | 3 | Determination of Unknown Resistance by ohms law | | |
| 8. | 5 | Power measurement in a single phase circuit. | | |
| 9. | 7 | Load test on a single phase transformer | | |
| 10. | 9 | Characteristics of PN Junction Diode | | |
| 11. | 11 | Construction of Bridge Rectifier | | |
| 12. | 13 | Verification of Logic Gates | | |

**Lab Assessment**

| Sl. No. | Rubrics (Sample) | Marks | | |
|---|---|---|---|---|
| | | **High 5-4** | **Medium 3-2** | **Low 1-0** |
| **Conduction of experiment** | | | | |
| 1. | Equipments Handling | Proper way of handling the equipments & tools. | Minimal handling of the equipments & tools. | unable to handling the equipments & tools |
| 2. | Observation | Step by step procedure followed to take correct readings. | Some steps are followed correct sequence & error to take readings | Steps are not followed to take readings and not showing interest to rectify the mistakes. |
| 3. | Presentation of results | Accurate results & neatly presented | Minor mistakes in results and neatly presented, | Major mistakes & Incomplete results. |
| 4 | Viva | Almost all the questions are answered. | Partially answered. | Unable to answer. |
| 5 | Promptness | The experiment is completed on time. Observation/Record note is submitted on time. | The experiment is completed on time but the Observation / Record note is not submitted on time. | The experiment is not completed on time. Observation / Record note is not submitted on time. |
| | Mark Allocation | 35 - 25 | 25 - 10 | 10 - 0 |

## AUTONOMOUS EXAMINATION

**Note:**

### DETAILLED ALLOCATION OF MARKS

| SCHEME OF EVALUATION | |
|---|---|
| Aim & Procedure | 15 |
| Tabulation & Readings /Circuit Diagram | 35 |
| Calculations | 35 |
| Result & Graph | 10 |
| Viva | 05 |
| Total | 100 |

# 5F3302 - PULP TECHNOLOGY LABORATORY

Programme Name : 5F3302-DIPLOMA IN PAPER TECHNOLOGY
Course Code : 5F3302
Term : III
Course Name : PULP TECHNOLOGY LABORATORY

## TEACHING AND SCHEME OF EXAMINATION

No of weeks per semester: 16 weeks

| Course | Instructions | | Examination | | | |
|---|---|---|---|---|---|---|
| | Hours / Week | Hours / Term | Marks | | | Duration |
| | | | Internal Assessment | Autonomous Examination | Total | |
| PULP TECHNOLOGY LABORATORY | 4 | 64 | 25 | 100* | 100 | 3 Hrs. |

*** Examinations will be conducted for 100 marks and it will be reduced to 75 marks.**

**RATIONALE**

Students will be given the idea of various processes to convert raw material to pulp. The status of Indian industries in relation to papermaking should be imparted to them. The use of pulp for various types of papermaking should also be emphasized

**OBJECTIVE**

After the completion of this course, the student should be able

- To analysis the cooking liquors and bleach liquor concentration.
- To analysis pulp freeness after refining
- To check the ash and moisture content of pulp
- To check the kappa number of pulp
- To make a hand sheet and checking the brightness & strength properties
- To measure the alkali loss in the washed pulp
- To study the post color number of given pulp
- To study the Effluent analysis from pulp mill.

**Course Outcomes:**

| Course outcome | | BTL |
|---|---|---|
| **CO1** | Able to analyze the content of White liquor, Bleaching Liquor, & Effluent from Pulp mill | **R** |
| **CO2** | Able to measure the freeness of pulp | **A** |
| **CO3** | Able to check moisture, ash & washing loss in pulp | **A** |
| **CO4** | Able to check kappa number in pulp | **A** |
| **CO5** | Know how to make how to make hand sheets | **U** |

**Mapping Course Outcomes (CO) - Program Outcomes (PO)**

| CO | Program Outcomes (PO) | | | | | | | Program Specific Outcomes (PSO) | |
|---|---|---|---|---|---|---|---|---|---|
| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PSO1 | PSO2 |
| CO1 | | | | | | | | | |
| CO2 | | | | | | | | | |
| CO3 | | | | | | | | | |
| CO4 | | | | | | | | | |
| CO5 | | | | | | | | | |
| TOTAL | | | | | | | | | |
| No. of COs Mapping with POs | | | | | | | | | |
| Average | | | | | | | | | |
| Round off(Average) | | | | | | | | | |
| Correlation | | | | | | | | | |
| Strong – S / 3 | | | Medium – M /2 | | | | Weak – W / 1 | | |

## DETAILED SYLLABUS

Contents: Practical

**Name of the Topics:**

**Exercise**

1. Analysis of cooking liquors
2. Freeness of pulps (CSF)
3. Ash and moisture content of pulp
4. Permanganate number / Kappa number of pulps
5. Analysis of Bleach liquor
6. Hand sheet making and brightness of pulp
7. Residual alkali in washed pulp (washing loss)
8. Effluent analysis from Pulp mill outlet

**Experiment Plan:**

| Module No. | Week No. | Experiments Name | Course Outcome | Weightage |
|---|---|---|---|---|
| | 3 | Analysis of cooking liquors | | |
| | 4 | Freeness of pulps (CSF) | | |
| | 5 | Ash and moisture content of pulp | | |
| | 6 | Analysis of Bleach liquor | | |
| | 8 | Hand sheet making and brightness of pulp | | |
| | 9 | Residual alkali in washed pulp (washing loss) | | |
| | 10 | Effluent analysis from Pulp mill outlet | | |
| | 11 | Permanganate number / Kappa number of pulps | | |

**Lab Assessment**

| Sl. No. | Rubrics (Sample) | Marks | | |
|---|---|---|---|---|
| | | **High 5-4** | **Medium 3-2** | **Low 1-0** |
| **Conduction of experiment (Software)** | | | | |
| 1. | Equipments & Sample Handling | Proper, Safest way of Chemical, Equipment Handling & Usage of PPE | Minimum usage of Proper , Safest way to Chemical, Equipment Handling & Usage of PPE | Safe less & Easiest way of Chemical, Equipment Handling without using PPE |
| 2. | Observation & Calculation | All the steps are followed correctly, sequence of Chemical addition & way of titration | Some steps are followed correctly, sequence of Chemical addition & way of titration | Steps are not followed correctly, sequence of Chemical addition & way of titration |
| 3. | Presentation of results | Accurate results & Calculation. Neatly presented | Complete and neatly presented, Minor mistakes in Result & Calculation | Incomplete results, Mistakes in Calculation Sequence |
| 4 | Viva | Almost all the questions are answered. | Partially answered | Unable to answer. |
| 5 | Promptness | The experiment is Completed on time. Observation/Record note is submitted on time | The experiment is completed on time but the Observation / Record note is not submitted on time. | The experiment is not completed on time. Observation / Record note is not submitted on time. |
| | Mark Allocation | 25-20 | 15-10 | 5-0 |

## AUTONOMOUS EXAMINATION

**Note:**

### DETAILLED ALLOCATION OF MARKS

| SCHEME OF EVALUATION | |
|---|---|
| Aim & Procedure | 15 |
| Tabulation & Readings | 35 |
| Calculations | 35 |
| Result & Graph | 10 |
| Viva | 05 |
| Total | 100 |

## Autonomous Examination-Question Paper Pattern

## MODEL QUESTION PAPER

## LIST OF EQUIPMENTS

### LIST OF GLASS WARES AND EQUIPMENTS

- Burette 50 ml
- Pipette 5 ml, 10ml, 25ml, 50 ml
- Conical flask 250 ml
- Standard flask 250 ml
- Burette stand with clamp
- Funnels
- Wash bottle
- Buchner funnel
- Canadian standard freeness tester
- Porcelain crucible, Muffle Furnace or Ash Incinerator and Air oven
- Mechanical stirrer
- Hand sheet making unit, Rapid sheet dryer and Brightness tester
- Vacuum pump and filtration setup
- $P^H$ Meter, silica dish and Hot plate

## 5F4303 - PULPING OPERATION, ELECTRICAL & MECHANICAL MAINTENANCE

Programme Name : DIPLOMA IN PAPER TECHNOLOGY
Course Code : 5F4303
Term : IV
Course Name : PULPING OPERATION, ELECTRICAL & MECHANICAL MAINTENANCE

### TEACHING AND SCHEME OF EXAMINATION

No of weeks per semester: 16 weeks

| Course | Instructions | | Examination | | | |
|---|---|---|---|---|---|---|
| | | | Marks | | | Duration |
| | Hours / Week | Hours / Term | Internal Assessment | Autonomous Examination | Total | |
| PULPING OPERATION, ELECTRICAL & MECHANICAL MAINTENANCE | 24 | 576 | 25 | 100* | 100 | 3 Hrs. |

*** Examinations will be conducted for 100 marks and it will be reduced to 75 marks.**

**RATIONALE**

The basic idea of washing, screening, cleaning and bleaching given to the students with an aim to reduce pollution load on one side and energy and chemical recovery on the other in order to get a clean and bright pulp. The technological overview based on block diagram should only be emphasized ideas of emission from bleach plant should be given.

**OBJECTIVES**

At the end of this course, students will be able to

- Know various pulping and methods, general principle and objectives of washing
- Know the method of washing and types
- Know the washing principle and construction of brown stock washer, description of multistage washer, operating procedure including start up and shut down
- Know the variables affecting efficiencies, production rate, loading factors
- Know the screening procedure and methods. Variables affecting the screen performance
- Know the bleaching principle and its operations
- Know the all unit operations and their electrical and mechanical maintenance system

By the end of in plant training the students will get

- Hands on training in pulping operations
- Thorough knowledge of conversion of raw materials in to pulp
- Knowledge about cooking operations of raw materials
- Knowledge about chip & liquor filling into digester

**Course Outcomes:**

| Course outcome | | BTL |
|---|---|---|
| **CO1** | Understand various pulping operation | **Ap** |
| **CO2** | Understand conversion of raw materials into pulp | **Ap** |
| **CO3** | Understand cooking operation & cooking conditions of different raw materials | **Ap** |
| **CO4** | Understand all the Unit operation, Electrical maintenance & Mechanical maintenance | **Ap** |
| **CO5** | Understand various washing & bleaching methods and their parameters | **Ap** |

**Mapping Course Outcomes (CO) - Program Outcomes (PO)**

| CO | Program Outcomes (PO) | | | | | | | Program Specific Outcomes (PSO) | |
|---|---|---|---|---|---|---|---|---|---|
| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PSO1 | PSO2 |
| CO1 | | | | | | | | | |
| CO2 | | | | | | | | | |
| CO3 | | | | | | | | | |
| CO4 | | | | | | | | | |
| CO5 | | | | | | | | | |
| TOTAL | | | | | | | | | |
| No. of COs Mapping with POs | | | | | | | | | |
| Average | | | | | | | | | |
| Round off(Average) | | | | | | | | | |
| Correlation | | | | | | | | | |
| Strong – S / 3 | | | Medium – M /2 | | | | Weak – W / 1 | | |

## 5F4304 - CHEMICAL RECOVERY OPERATION & MAINTENANCE

Programme Name : DIPLOMA IN PAPER TECHNOLOGY
Course Code : 5F4304
Term : IV
Course Name : CHEMICAL RECOVERY OPERATION & MAINTENANCE

### TEACHING AND SCHEME OF EXAMINATION

No of weeks per semester: 16 weeks

| Course | Instructions | | Examination | | | |
|---|---|---|---|---|---|---|
| | | | Marks | | | Duration |
| | Hours / Week | Hours / Term | Internal Assessment | Autonomous Examination | Total | |
| CHEMICAL RECOVERY OPERATION & MAINTENANCE | 24 | 576 | 25 | 100* | 100 | 3 Hrs. |

*** Examinations will be conducted for 100 marks and it will be reduced to 75 marks.**

**RATIONALE**

Chemical recovery plant is a part and parcel of any modern day paper mill. Chemical recovery plant aids in abating air and water pollution and its effects. The recovery and reuse of cooking chemicals to the extent of 90% and utilize.

**OBJECTIVES**

Student will be able to Know

- Learn pollution and its effects
- Know about energy saving system using heat boiler
- Know the variables affecting the environment and their abatement
- Recovery and reuse of cooking chemicals
- To learn operating procedure and maintenance
- To reduce emission from recovery boiler & ESP operation and maintanace

After the in plant training is over the students will be able to understand

- How the black liquor is converted into white liquor
- How heat is recovered from recovery boiler
- Thorough knowledge about settling & Clarifier process.

**Course Outcomes:**

| Course outcome | | BTL |
|---|---|---|
| **CO1** | Understand the conversion process of black liquor to white liquor | **U** |
| **CO2** | Understand the various process step involves in the evaporators | **U** |
| **CO3** | Understand the recovery of Heat & white liquor chemicals in recovery boiler | **U** |
| **CO4** | Understand the process and process parameters of Causticizer & Lime Kiln | **U** |
| **CO5** | Understand all the Unit operation, & Mechanical maintenance in recovery process | **U** |

**Mapping Course Outcomes (CO) - Program Outcomes (PO)**

| CO | Program Outcomes (PO) | | | | | | | Program Specific Outcomes (PSO) | |
|---|---|---|---|---|---|---|---|---|---|
| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PSO1 | PSO2 |
| CO1 | | | | | | | | | |
| CO2 | | | | | | | | | |
| CO3 | | | | | | | | | |
| CO4 | | | | | | | | | |
| CO5 | | | | | | | | | |
| TOTAL | | | | | | | | | |
| No. of COs Mapping with POs | | | | | | | | | |
| Average | | | | | | | | | |
| Round off(Average) | | | | | | | | | |
| Correlation | | | | | | | | | |
| Strong – S / 3 | | | Medium – M /2 | | | | Weak – W / 1 | | |

## 5F0005 - CONCURRENT CAREER DEVELOPMENT

Programme Name : DIPLOMA IN PAPER TECHNOLOGY
Course Code : 5F0005
Term : IV
Course Name : Concurrent Career Development

**TEACHING AND SCHEME OF EXAMINATION**

No of weeks per semester: 16 weeks

| Course | Instructions | | Examination | | | |
|---|---|---|---|---|---|---|
| | Hours / Week | Hours / Term | Marks | | | Duration |
| | | | Internal Assessment | Autonomous Examination | Total | |
| Concurrent Career Development | 5 | 80 | 25 | 100* | 100 | 3 Hrs. |

*** Examinations will be conducted for 100 marks and it will be reduced to 75 marks.**

**Topics and Allocation of Hours**

| UNIT | Topic | Hrs. |
|---|---|---|
| I | National Integration And Awareness | 15 |
| II | Social Awareness And Community Development | 15 |
| III | Health And Hygiene | 15 |
| IV | Environmental Awareness And Conservation | 14 |
| V | Traffic Control Organization | 14 |
| Test & Model Exam | | 7 |
| **Total** | | **80** |

**OBJECTIVES:**

1. To promote harmony and the spirit of common brotherhood amongst all the people of the country. To safe guard public property and abjure violence.
2. To develop the idea of ability and better thinking to work for the betterment of community.
3. To prevent illness and have positive health attitude, correct and complete knowledge of health is necessary.
4. To develop a world population that is aware of, and concerned about, the environmental and its associated problems
5. To provide for the safe, rapid, comfortable efficient, convenient, and environmentally compatible movement of people, goods, and services.

## Course Outcome

**On successful completion of the course, the students will be able to attain below Course Outcome (CO):**

| Course outcome | | BTL |
|---|---|---|
| **CO1** | Students to know the responsibility to see that injustice, inequality, oppression; exploitation, corruption, misuse of public money etc. are done away with. Students play a vital role in the society. They are the guardians of freedom, Justice, equality, ethics and social equilibrium. | **U** |
| **CO2** | To understand social and ethical norms for behavior, and to recognize family, school, and community resources and supports. | **U** |
| **CO3** | Students have the knowledge or skills to develop good personal hygiene habits on their own. | **U** |
| **CO4** | To understand the fragility of our environment and the importance of its protection. | **U** |
| **CO5** | The students will get a vast understanding on various traffic enforcements rules and regulations. | **U** |

**Legends:** R = Remember U= Understand; A= Apply and above levels (BTL-Bloom's revised taxonomy Level)

**Mapping Course Outcomes (CO) - Program Outcomes (PO)**

| CO | Program Outcomes (PO) | | | | | | | Program Specific Outcomes (PSO) | |
|---|---|---|---|---|---|---|---|---|---|
| | PO1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PSO1 | PSO2 |
| CO1 | 2 | 2 | 1 | 2 | - | - | - | - | - |
| CO2 | 2 | 2 | 1 | 2 | - | - | - | - | - |
| CO3 | 2 | 2 | 1 | 2 | - | - | - | - | - |
| CO4 | 2 | 2 | 1 | 2 | - | - | - | - | - |
| CO5 | 2 | 2 | 1 | 2 | - | - | - | - | - |
| TOTAL | 10 | 10 | 5 | 10 | - | - | - | - | - |
| No. of COs Mapping with POs | 5 | 5 | 5 | 5 | - | - | - | - | - |
| Average | 2 | 2 | 1 | 2 | - | - | - | - | - |
| Round off(Average) | 2 | 2 | 1 | 2 | - | - | - | - | - |
| Correlation | | | | | | | | | |
| Strong – S / 3 | | Medium – M /2 | | | | Weak – W / 1 | | | |

## DETAILED SYLLABUS

Contents: Concurrent Career Development

| Unit | Name of the Topics | Hours |
|---|---|---|
| I | **NATIONAL INTEGRATION AND AWARENESS**<br>Introduction – Importance of National Integration – Essence of national integration : Cultural Integration, Economic Integration, Political Integration, Religious Integration, Social Integration- Necessity of National Integration : Maintenance of peace and harmony, Growth and development of the nation, Law and Order, Culture and religious development, dignity and self-respect, welfare and wellbeing of the people-Role of NCC in nation Building. | 15 |
| II | **SOCIAL AWARENESS AND COMMUNITY DEVELOPMENT**<br>Need of social awareness – Types of Social Awareness : Empathy, Organizational awareness- Service – How to build Social Awareness – Aims of Social Awareness – Different Social Awareness Programmes – Aims of Community development – Different community awareness programmes | 15 |
| III | **HEALTH AND HYGIENE**<br>Introduction to the structure of the body – Personal hygiene – Food hygiene –water supply and its purification – Sanitisation – Waste Product / Refuse – Types of waste product – Sources of refuse – Collection and removal of refuse – Preventable diseases – Classification of disease – Preventive measures Yoga – Definition and meaning of Yoga-Principles of Yoga- Asana – Definition, Types, Benefits - Effect of various yogic practices on Respiratory and Circulatory system - Method of performing various asanas – Padmasana, Siddhasana, Gyan Muthra, Suryanamaskar. Physical and Mental health – Elements of good health – Objectives and scopes of health education – Characteristics of healthy mind, Measures to secure mental health | 15 |
| IV | **ENVIRONMENTAL AWARENESS AND CONSERVATION**<br>Introduction- Human activities and the environment – Depletion and deterioration – Deforestation – Forest and wild life – Water Resources – Global Warming – Depletion of Ozone layer – Role of the NCC cadets towards the environment – Ecology – Definition and components Conservation of environment and ecology – Resource depletion – Resource pollution – Environmental damage – Environment, life and ecology – Conservation measures – Methods of managements and conservation of natural resources. | 14 |

| | | |
|---|---|---|
| V | **TRAFFIC CONTROL ORGANIZATION**<br>Understanding Road Safety – Importance or road safety: Major causes of road accident – Role of Education sector in road safety – Role of general Community in road safety – Road Safety tips – Safety Devices – Safe and Responsible driving : Getting ready to drive before driving, Physical and mental alertness, Know your vehicle, Know your blind spots, Fasten Your seat belt, Turn on head lights at night and in poor light conditions – Driving License. | 14 |

**ASSESSMENT:**

This is a compulsory credit course. The assessment is to provide a fair State of development of the student, so participation in classroom discussions, etc. will be used in evaluation.

- Final marks = 25% of Assignment mark + 50% of Online exam mark (Proctored) + 25 % of External exam (proctored).
- Unproctored means candidate will be taking the exam from college.
- The overall pass percentage is 40%.

**Reference Books**


1. Cadet's Hand Book.
2. Public Health And Hygiene, Dr.Sudhar R.Wagh.
3. Question Answers Of Environment And Road Safety Awareness Kindle Edition By Brijesh Pathak (Author) .
4. Environment And Road By Naresh Kumar (Author).
5. Traffic Safety And Environment: Conflict Or Integration Author Links Open Overlay Panelburkhard E.Horn (Professor) A. Hh.Jansson.

## 5F5305 - PULP AND PAPER TECHNOLOGY II

Programme Name : DIPLOMA IN PAPER TECHNOLOGY.

Course Code : 5F5305

Term : V

Course Name : PULP AND PAPER TECHNOLOGY-II

### TEACHING AND SCHEME OF EXAMINATION

No of weeks per semester: 16 weeks

| Course | Instructions | | Examination | | | |
|---|---|---|---|---|---|---|
| | Hours / Week | Hours / Term | Marks | | | Duration |
| | | | Internal Assessment | Autonomous Examination | Total | |
| Pulp And Paper Technology-II | 5 | 20 | 25 | 100* | 100 | 3 Hrs. |

*** Examinations will be conducted for 100 marks and it will be reduced to 75 marks.**

### Topics and Allocation of Hours

| UNIT | Topic | Hrs. |
|---|---|---|
| I | Sulphate Pulping | 15 |
| II | Sulphite Pulping & Mechanical Pulping & Semi Chemical Pulping | 14 |
| III | Pulping and Pretreatment of Rags & Secondary fibre treatment | 15 |
| IV | Washing & Screening and Centric leaning | 14 |
| V | Bleaching | 15 |
| Test & Model Exam | | 7 |
| **Total** | | 80 |

**RATIONALE**

The student will be given thorough knowledge of sulphate, sulphite, semi chemical pulping and rag pulping. The students will also get the knowledge of deinking, sheet formation and pressing etc.

**OBJECTIVE**

At the end of this course, students will be able to know about different pulping method and deinking

- Chemical pulping (sulphate pulping) standard terms used
- Chemical composition of cooking liquor
- Sulphite pulping and semi chemical pulping
- preparation of cooking liquor
- Process variables
- Factors effecting sulphite pulping
- Characteristics of sulphite pulping
- Mechanical pulping:
- The history and development of papermaking, Type of paper making machine and the role of screening and cleaning operation before sheet formation, Role and control of consistency in papermaking approach Flow system & its significance.
- Head Box designs and development
- The operation of water – Washing efficiency. Types of washing equipment. The screening introduction and principles.
- The aims of bleaching. The sequence of bleaching methods, the auxiliary equipments of bleaching

## Course Outcome

***On successful completion of the course, the students will be able to attain below Course Outcome (CO):***

| Course outcome | | BTL |
|---|---|---|
| **CO1** | Understand the basic concepts, process steps & process parameters of sulphate pulping | **R** |
| **CO2** | Understand the basic concepts, process steps & process parameters Sulphite Pulping, Mechanical Pulping & Semi Chemical Pulping | **A** |
| **CO3** | Understand the the basic concepts, process steps & process parameters pretreatment and pulping of rags and waste paper | **A** |
| **CO4** | Understand the process of Washing & Screening and Centric Cleaning | **A** |
| **CO5** | Understand the bleaching process and their sequences | **U** |

**Legends:** R = Remember U= Understand; A= Apply and above levels (BTL-Bloom's revised taxonomy Level)

**Course-PO Attainment Matrix**

| CO | Program Outcomes (PO) | | | | | | | Program Specific Outcomes (PSO) | |
|---|---|---|---|---|---|---|---|---|---|
| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PSO1 | PSO2 |
| CO1 | | | | | | | | | |
| CO2 | | | | | | | | | |
| CO3 | | | | | | | | | |
| CO4 | | | | | | | | | |
| CO5 | | | | | | | | | |
| TOTAL | | | | | | | | | |
| No. of COs Mapping with POs | | | | | | | | | |
| Average | | | | | | | | | |
| Round off(Average) | | | | | | | | | |
| Correlation | | | | | | | | | |
| Strong – S / 3 | | | Medium – M /2 | | | | Weak – W / 1 | | |

*Method is to relate the level of PO with the number of hours devoted to the COs which address the given PO.*

- If ≥40% of classroom sessions addressing a particular PO, it is considered that PO is addressed at Level 3
- If 25 to 40% of classroom sessions addressing a particular PO, it is considered that PO is addressed at Level 2
- If 5 to 25% of classroom sessions addressing a particular PO, it is considered that PO is addressed at Level 1
- If < 5% of classroom sessions addressing a particular PO, it is considered that PO is considered not-addressed.

## DETAILED SYLLABUS

Contents: Theory

| Unit | Name of the Topics | Hours |
|---|---|---|
| I | **UNIT I: SULPHATE PULPING**<br>**Chapter 1.1 -** Introduction to chemical pulping – Introduction to sulphate pulping process – Advantages and disadvantage of sulphate pulping Standard terms (Applicable only to pulping process) – Complete cooking cycle of batch digester wit reference to stationary vertical digester – Illustration of RDH/Super Batch process. – Uses of black liquor – Air pollution – Problems to calculate the volumes of WL and BL using bath ratio of a stationary digester – Chemical reactions in alkaline pulping- Process variables in sulphate cooking : i) Amount of alkali (as effective alkali) ii) Alkali Concentration iii) Sulphidity iv) Time and Temperature – H-factor (a short note with definition only) – Equipments details : Digester – Below tank – Preheater – Regenerators – Recuperators. | 15 |
| II | **Chapter 2.1 -** Outline of the process with block diagram – Sulphite pulping – Raw material suitability - A table of difference between sulphate and sulphite pulping – A qualitative treatment only on dissolving grade pulping<br>**Chapter 2.2 -** Introduction to the types of mechanical pulping- A block diagram and simple description of ground wood pulping process – Description of grinding with a neat diagram- Limitations of ground wood pulps<br>**Chapter 2.3 -** Principle and scope – Advantages of SC process – Properties of SC pulps – A note on pulp yield –Types of SC process – NSSC (bath process and typical cooking conditions ) A note on α β and *r* celluloses. | 14 |
| III | **Chapter 3.1 -** Properties and uses of rag pulps- A note on pulping of cotton linters<br>**Chapter 3.2 -** Process description with plant Diagram, Deinking(wastepaper treatment)- Advantages and disadvantages of deinked stock- A brief note on deinking chemicals-A qualitative account on deinking plant- Shrinkage and yield of Deinking- Properties and uses of Deinked pulps. | 15 |

| | | |
|---|---|---|
| IV | **Chapter 4.1 -** Reasons for washing – Chemical losses substances removed during washing – Washing efficiency – Dilution factor and displacement ratio (Qualitative treatment only) – Types of washing equipments – Diagram and description of diffusion washer and rotary drum washer – A complete diagram of a typical three stage countercurrent washing system – Twin roll press – Operational factors affecting washing efficiency – A note on knotter – Unit operations in washing<br>**Chapter 4.2 -** Introduction-Screening and principles – Nature of impurities – Important variables in screening – Cascading principle of centricleaners – A typical flow diagram of modern screening plant and its description. | 14 |
| V | **Chapter 5.1 -** Introduction and aims of bleaching – Bleaching chemicals – Principles of their chemical analysis – Bleach ability of pulps – Single stage and multistage bleaching – Chlorine water system and its significances in bleaching – Peroxide and Hydrosulphite bleaching – Chlorine-di-oxide<br>treatment – Bleaching with a reducing agent – Introduction to Elemental chlorine-free bleaching process – Introduction to enzyme bleaching process – Chemical reactions in bleaching – Variables in bleaching – Bleaching equipments – Safety – Materials of construction.<br>**Chapter 5.2 -** Auxiliary equipments – Oxygen bleaching of mechanical pulps – A flow diagram with description of CEH/CEHH sequence only | 15 |

**Reference Books**


1 Hand book of pulp and paper technology Kenneth W. Britt CBS Publishers

2 pulp and paper volume I and II James P. Casey Academic Press

3 Pulping process Sven A. Rydholm Inter science publisher

4 Pulp and paper Manufacture I and II Ronald G Macdonald Wiley & Sons

## 5F5208 - UNIT OPERATIONS

Programme Name : DIPLOMA IN PAPER TECHNOLOGY.

Course Code : 5F5208

Term : V

Course Name : UNIT OPERATIONS

### TEACHING AND SCHEME OF EXAMINATION

No of weeks per semester: 16 weeks

| Course | Instructions | | Examination | | | |
|---|---|---|---|---|---|---|
| | Hours / Week | Hours / Term | Marks | | | Duration |
| | | | Internal Assessment | Autonomous Examination | Total | |
| UNIT OPERATIONS | 5 | 80 | 25 | 100* | 100 | 3 Hrs. |

*** Examinations will be conducted for 100 marks and it will be reduced to 75 marks.**

### Topics and Allocation of Hours

| UNIT | Topic | Hrs. |
|---|---|---|
| I | Size Reduction & Screening | 15 |
| II | Conveying & Seperation of Matrials | 14 |
| III | Fundamentals of Heat Transfer | 15 |
| IV | Fundamentals of Heat Exchangers | 14 |
| V | Absorption, Humidification & Drying | 15 |
| Test & Model Exam | | 7 |
| **Total** | | 80 |

**RATIONALE**

It gives the student the knowledge of working of individual mechanical operations and their significance in chemical industries. With this information student can control the operation of equipment and regulate production. good understanding about the heat transfer mechanisms such as conduction, convection and radiation. These methods can then be used for understanding the performances of heat transfer equipment used in almost all chemical and related industries. In mass transfer Leaching , extraction, gas absorption and stripping, humidification and drying concepts have been elaborately discussed.

**OBJECTIVES**

At the end of this course, students must be able to know

- To understand important mass transfer operations and their applications.
- About the basic concepts about temperature, pressure.
- Size reduction
- About different size reduction equipment
- Characterization of solid particles
- Particle shape, particle size, mixed particle sizes and size analysis, expressions
- Different types of conveying equipment.
- Different types of centrifuge and difference between clarification and classification.
- Modes of Heat Transfer - Conduction, Convection, Radiation, concept of steady state and unsteady state heat transfer Conduction. Fourier's law of heat conduction, thermal conductivity of materials and solids,
- Concept, derivation and application of LMTD
- Black body radiation, Grey body, heat exchange between black & brown bodies, exchange of
- radiation between absorption and emission
- About double pipe, shell and multi pass heat exchanger
- About leaching and extraction equipments.
- About Humidification and drying.
- About evaporations and its applications.

## Course Outcome

***On successful completion of the course, the students will be able to attain below Course Outcome (CO):***

| Course outcome | | BTL |
|---|---|---|
| **CO1** | Understand the construction and working principle of various size reduction and screening equipments | **R** |
| **CO2** | Understand the principle, construction & working of various conveying methods, filteration and settling equipments | **A** |
| **CO3** | Understand basic concepts of conduction, convection & radiation | **A** |
| **CO4** | Understand the principle, construction & working of heat exchanging equipments | **A** |
| **CO5** | Understand the principle, construction & working of gas absorption, Humidification & Drying equipments | **U** |

**Legends:** R = Remember U= Understand; A= Apply and above levels (BTL-Bloom's revised taxonomy Level)

**Course-PO Attainment Matrix**

| CO | Program Outcomes (PO) | | | | | | | Program Specific Outcomes (PSO) | |
|---|---|---|---|---|---|---|---|---|---|
| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PSO1 | PSO2 |
| CO1 | | | | | | | | | |
| CO2 | | | | | | | | | |
| CO3 | | | | | | | | | |
| CO4 | | | | | | | | | |
| CO5 | | | | | | | | | |
| TOTAL | | | | | | | | | |
| No. of COs Mapping with POs | | | | | | | | | |
| Average | | | | | | | | | |
| Round off(Average) | | | | | | | | | |
| Correlation | | | | | | | | | |
| Strong – S / 3 | | | Medium – M /2 | | | | Weak – W / 1 | | |

*Method is to relate the level of PO with the number of hours devoted to the COs which address the given PO.*

- If ≥40% of classroom sessions addressing a particular PO, it is considered that PO is addressed at Level 3
- If 25 to 40% of classroom sessions addressing a particular PO, it is considered that PO is addressed at Level 2
- If 5 to 25% of classroom sessions addressing a particular PO, it is considered that PO is addressed at Level 1
- If < 5% of classroom sessions addressing a particular PO, it is considered that PO is considered not-addressed.

## DETAILED SYLLABUS

Contents: Theory

| Unit | Name of the Topics | Hours |
|---|---|---|
| I | **SIZE REDUCTION & SCREENING**<br>**Chapter 1.1 -** units of temperature, pressure, and simple numerical of their inter conversion<br>**Chapter 1.2 -** Advantages – Important methods of size reduction – Classification of size reduction equipments namely Blake jaw crusher, Ball mill and Rotary Knife cutter<br>**Chapter 1.3 -**Average particles size– Screening – Notes on differential and cumulative sieve analysis (basic qualitative treatment only) | 15 |
| II | **CONVEYING & SEPERATION OF MATRIALS**<br>**Chapter 2.1 -** Belt conveyor – Bucket elevator – Screw conveyor and Pneumatic conveyors<br>**Chapter 2.2 -** Clarification and classification flocculation – Free and hindered setting – Sink and float methods sedimentation –Setting equipment namely Gravity thickener. (all heating describe treatment only)<br>**Chapter 2.3 -** Principle – Construction and operation of filtration equipment namely continuous Rotary drum vacuum filter.<br>**Chapter 2.4 -** Principle of a Centrifuge and construction and operation of Simple basket centrifuge | 14 |
| III | **FUNDAMENTALS OF HEAT TRANSFER**<br>**Chapter 3.1 -** Modes of heat transfer – Conduction, convection and radiation – Examples Conduction:- Fourier's law – Heat flow through a flat wall Thermal conductivity – Analogy between heat conduction and electricity simple numerical on heat flow through a flat wall.<br>**Chapter 3.2 -** Natural and forced convection – Example – Heat flux Surface(individual heat transfer) coefficients – Overall coefficient Fouling factors – Simplification of overall coefficient – Simple numerical involving surface and overall coefficients on simplified overall coefficient formulae Mention of four dimensionless numbers namely Length to Diameter ratio, Reynolds's no,prantl's no Nusselt no, (formulae only) | 15 |

| | | |
|---|---|---|
| IV | **FUNDAMENTALS OF HEAT EXCHANGERS**<br>**Chapter 4.1 -** Concept of LMTD – Parallel and counter current flow – Applications – Simple numerical on LMTD for parallel and counter flows Equipments :- Double pipe heat exchanger – Simple 1-1Shell and tube heat exchanger with sketches<br>**Chapter 4.2 -** Wavelengths of thermal radiation – Thermal radiation – Blackbody Greybody, Absorptivity, emmisivity – Comparison of conduction-convection-radiation.<br>**Chapter 4.3 -** Evaporation – Liquid characteristics – Evaporator types namely falling film evaporators – Single effect and multiple effect evaporation Material balance ofsingle effect evaporator – Material balance for a triple effect evaporator – capacity, steam economy and elevation in boiling point. (Definition and description only) – Simple numerical on material balance of single effect evaporators – Simple numerical on material balance of triple effect evaporators | 14 |
| V | **ABSORPTION, HUMIDIFICATION & DRYING**<br>**Chapter 5.1 -** Gas absorption – construction and operation of packed tower for absorption – Important tower packing characteristics of tower packing.<br>**Chapter 5.2 -** Humidification – dehumidification - definition of humidity Industrial water cooling using Natural draft and Mechanical draft cooling towers.<br>**Chapter 5.3 -** Drying – Definition - moisture – Bound and unbound moisture – Free moisture – Drying equipment –Tray drier – cylinder drier. | 15 |

**Reference Books**


1 Chemical Engineering Hand book- Seventh edition Robert H .Perry-and D.W. Green Perry's McGraw Hill

2 Principles of unit operations A.S. Foust etal., Willey & Sons

3 Chemical Engineering- Vol. I & II J.M. Coulson & J.F. Richardson Morgan Kauffman publishers

4 Unit operation in chemical engineering Warren L. McCabe And Julian D. Smith McGraw Hill

5 Introduction to chemical engineering Walter L. Badger and Julius T. Banchero Tata McGraw Hill

## 5F5402 - PROCESS INSTRUMENTATION AND CONTROL

Programme Name : DIPLOMA IN PAPER TECHNOLOGY.

Course Code : 5F5402

Term : V

Course Name : Process Instrumentation & Control

### TEACHING AND SCHEME OF EXAMINATION

No of weeks per semester: 16 weeks

| Course | Instructions | | Examination | | | |
|---|---|---|---|---|---|---|
| | Hours / Week | Hours / Term | Marks | | | Duration |
| | | | Internal Assessment | Autonomous Examination | Total | |
| Process Instrumentation & Control | **5** | **80** | **25** | **100*** | **100** | **3 Hrs.** |

* Examinations will be conducted for 100 marks and it will be reduced to 75 marks.

### Topics and Allocation of Hours

| UNIT | Topic | Hrs. |
|---|---|---|
| I | Measurement Of Temperature And Pressure | 15 |
| II | Measurement Of Flow And Level | 14 |
| III | Measurement Of pH, Humidity And Viscosity | 15 |
| IV | Process control and Automatic controller | 14 |
| V | Computer Controlled Processes | 15 |
| Test & Model Exam | | 7 |
| **Total** | | 80 |

**RATIONALE:**

Most of the papermaking operations will involve measurement of temperature and pressure, flow and level, pH, humanity and viscosity, process control. It is, therefore, extremely necessary to have good knowledge about this methods can then be useful for understanding the working principle construction, repair and use of these equipments. Various instrument used to measure various process parameters.

**OBJECTIVES:**

. At the end of this course, students will be able to know

- Purpose of instrumentation and instruments used for measuring the temperature. Different types of manometers.
- The measurement different types of flow and level measurement. Capacitance and conductivity type level sensors.
- The definition of pH, humidity and viscosity
- Process control principles and purpose of feedback control. Different types of controllers. Pneumatic Controllers-concept and application only in Pneumatic system, The control applications in reactor temperature, reactor pressure, heat exchanger.
- The computer controlled processes like analog signal to digital DCS, supervisory control simple control flow sheets using computer.

## Course Outcome

***On successful completion of the course, the students will be able to attain below Course Outcome (CO):***

| Course outcome | | BTL |
|---|---|---|
| **CO1** | Identify construction, working principles & uses of different instruments used for pressure and temperature measurement | **R** |
| **CO2** | Identify construction, working principles & uses of different instruments used for flow and level | **R** |
| **CO3** | Identify construction, working principles & uses of different instruments used for pH, Humidity & Viscosity | **R** |
| **CO4** | Understand different types of process control methods | **U** |
| **CO5** | Understand construction, working of PLC & DCS | **U** |

**Legends:** R = Remember U= Understand; A= Apply and above levels (BTL-Bloom's revised taxonomy Level)

**Course-PO Attainment Matrix**

| CO | Program Outcomes (PO) | | | | | | | Program Specific Outcomes (PSO) | |
|---|---|---|---|---|---|---|---|---|---|
| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PSO1 | PSO2 |
| CO1 | | | | | | | | | |
| CO2 | | | | | | | | | |
| CO3 | | | | | | | | | |
| CO4 | | | | | | | | | |
| CO5 | | | | | | | | | |
| TOTAL | | | | | | | | | |
| No. of COs Mapping with POs | | | | | | | | | |
| Average | | | | | | | | | |
| Round off(Average) | | | | | | | | | |
| Correlation | | | | | | | | | |
| Strong – S / 3 | | | Medium – M /2 | | | | Weak – W / 1 | | |

*Method is to relate the level of PO with the number of hours devoted to the COs which address the given PO.*

- If ≥40% of classroom sessions addressing a particular PO, it is considered that PO is addressed at Level 3
- If 25 to 40% of classroom sessions addressing a particular PO, it is considered that PO is addressed at Level 2
- If 5 to 25% of classroom sessions addressing a particular PO, it is considered that PO is addressed at Level 1
- If < 5% of classroom sessions addressing a particular PO, it is considered that PO is considered not-addressed.

## DETAILED SYLLABUS

Contents: Theory

| Unit | Name of the Topics | Hours |
|---|---|---|
| I | **Chapter: 1.1:** Units - General purpose of instrumentation - Instruments for measuring temperature - Liquid and gas filled thermometers, Bimetallic thermometers, Electrical resistance thermometers, Thermocouples - Principles, different types and their application -Thermopiles, Thermistors, Radiation pyrometer and Optical pyrometer.<br>**Chapter: 1.2:** Units – different types of pressure & measurements - Mc Leod gauge- Bourdon gauge-Principle, Different types of bourdon tubes, application, Bellows type and diaphragm type pressure sensors - Vacuum measurement - Ionisation vacuum gauge, Pirani gauge.<br>**Chapter: 1.3:** LVDT, Strain gauge sensor, Piezo resistive pressure sensor | 15 |
| II | **Chapter: 2.1:** Units - Head flow meters: Orifice and Venturi – Pitot tube, Ultrasonic flow measurement, vortex flow measurement, Area flow meters - Rotameter – Metering pumps, Notating disc meter, Magnetic flow meter. Level measurement: Visual indicator methods - Float level indicator - Bubbler type - Displacement type level indicator - Capacitance and conductivity type level sensors – Nuclenic level gauge. | 14 |
| III | **Chapter: 3.1:** $P^H$ & Conductivity, definition, significance-Method of measuring. Humidity - definition of absolute and relative humidity - Measurement of humidity - Dry and wet bulb thermometer - Hair hygrometer, Sling psychomotor. Viscosity - Absolute and kinematic viscosity - Viscosity measurement - Say bolt and Redwood viscometer - Falling- ball viscometer. | 15 |
| IV | **Chapter: 4.1:** Process Control Open loop & closed loop Systems – Principles and purpose of Feed Back Control – Feed Forward Control – Ratio Control – Cascade control<br>**Chapter: 4.2:** controllers- classification - based on control action such as P,I,PI,PD,PID based on actuating medium such as Pneumatic Controllers-concept and application only in Pneumatic system. Block | 14 |

| | | |
|---|---|---|
| | Diagrams – Sources of Process lag – Control applications in (i) Reactor Temperature (ii) Reactor Pressure (iii)Heat exchanger – Temperature, Flow (iv)Distillations Column-Temperature, Flow, Process. | |
| V | **Chapter: 5.1:** Analog Signal from processes - conversion of analog signal to digital signal in computers computer programmes- conversion of digital signal to analog signal – PLC – Difference between PLC & DCS<br>**Chapter: 5.2:** Distributed control systems (DCS) – Machine control systems – Quality Control Systems – Networking – Advanced Process Control systems – Enterprises Resource planning. | 15 |

**Reference Books**

| Sl.No | Name of the Book | Author | Publisher |
|---|---|---|---|
| 1 | Industrial instrumentation | Donald P. Eckman | New Age international (P) Publication |
| 2 | Instrumental methods of chemical analysis | B.K. Sharma | Goal publishing House private Ltd |
| 3 | Perry's chemical Engineering Hand Book – Seventh edition | Robert H. Perry & D.W. Green | Mc Graw Hill Book Co.Singapore |
| 4 | Instrumental methods of analysis | H.H. Willard, etal | D Van No strand Co., |

## 5F5209 - ENTREPRENEURSHIP AND STARTUPS

Programme Name : DIPLOMA IN PAPER TECHNOLOGY

Course Code : 5F5209

Term : V

Course Name : **ENVIRONMENTAL ENGINEERING LAB**

### TEACHING AND SCHEME OF EXAMINATION

No of weeks per semester: 16 weeks

| Course | Instructions | | Examination | | | |
|---|---|---|---|---|---|---|
| | Hours / Week | Hours / Term | Marks | | | Duration |
| | | | Internal Assessment | Autonomous Examination | Total | |
| ENVIRONMENTAL ENGINEERING LAB | 4 | 64 | 25 | 100* | 100 | 3 Hrs. |

* Examinations will be conducted for 100 marks and it will be reduced to 75 marks.

**RATIONALE:**

Students will be given the idea of various processes to measurement of Temperature using Thermocouple module, RTD module, and pressure using strain gauge type Transducer, dead weight tester. The status of Indian industries in relation to pulp making should be imparted to them. The use of pulp for various types of papermaking should also be emphasized.

**OBJECTIVES:**

After completion of this practical, the student should be able to construct

- To know the measurement of Temperature
- To know the measurement of pressure
- To know the basic definition and standard terms used in pulp and paper industries Calibration of pressure gauges, Liquid level ON – OFF Control, Demonstration of flow rate control
- To know the types of P, PI control, PID Control using PID controller Trainer Kit
- To know the characteristics of flow control valve and temperature ON – OFF Control
- To know the analysis of instrumentation Failure and Linear variable Differential Transformer Module

**Course Outcomes:**

| Course outcome | | BTL |
|---|---|---|
| **CO1** | Determine COD, BOD & DO in water samples | **R** |
| **CO2** | Determine $P^H$, Electrical conductivity, acidity, alkalinity & Turbidity of given water sample | **A** |
| **CO3** | Determine solid contents | **A** |
| **CO4** | Determine break point chlorination for the given water sample | **A** |
| **CO5** | Find amount of optimum coagulant dosage needed for the given water sample | **U** |

**Mapping Course Outcomes (CO) - Program Outcomes (PO)**

| CO | Program Outcomes (PO) | | | | | | | Program Specific Outcomes (PSO) | |
|---|---|---|---|---|---|---|---|---|---|
| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PSO1 | PSO2 |
| CO1 | | | | | | | | | |
| CO2 | | | | | | | | | |
| CO3 | | | | | | | | | |
| CO4 | | | | | | | | | |
| CO5 | | | | | | | | | |
| TOTAL | | | | | | | | | |
| No. of COs Mapping with POs | | | | | | | | | |
| Average | | | | | | | | | |
| Round off(Average) | | | | | | | | | |
| Correlation | | | | | | | | | |
| Strong – S / 3 | | | Medium – M /2 | | | | Weak – W / 1 | | |

## DETAILED SYLLABUS

Contents: DEPARTMENT PAPER TECHNOLOGY

**NAME OF THE TOPICS: Process Instrumentation & Control Practical**

**Exercise:**

1. Determination of chemical oxygen demand (COD).
2. Determination of dissolved oxygen (D.O)
3. Determination of biological oxygen demand (BOD)
4. Estimation of optimum coagulant dosage
5. Determination of solids (TSS & TDS)
6. Determination of the Turbidity, Electrical Conductivity and pH of the given sample
7. Determination of acidity in process water,
8. Determination of alkalinity in process water.
9. Analysis of ions: copper, chlorides and sulfate
10. Determination of break point chlorination

**Experiment Plan:**

| Module No. | Week No. | Experiments Name | Course Outcome | Weightage |
|---|---|---|---|---|
| 1 | 3 | Determination of chemical oxygen demand (COD). | | |
| 2 | 4 | Determination of dissolved oxygen (D.O) | | |
| 3 | 5 | Determination of biological oxygen demand (BOD) | | |
| 4 | 6 | Estimation of optimum coagulant dosage | | |
| 5 | 7 | Determination of solids (TSS & TDS) | | |
| 6 | 8 | Determination of the Turbidity, Electrical Conductivity and pH of the given sample | | |
| 7 | 9 | Determination of acidity in process water, | | |
| 8 | 10 | Determination of alkalinity in process water. | | |
| 9 | 11 | Analysis of ions: copper, chlorides and sulfate | | |
| 10 | 12 | Determination of break point chlorination | | |

## LIST OF EQUIPMENTS

- Conical flasks 250 ml
- Burners
- Tripod stand and wire gauze
- Burette stand with clamp
- Burettes 50 ml
- Pipettes 5ml, 10ml, 20ml, 25ml
- Funnels
- DO Meter And DO testing kit
- BOD incubator Erlenmeyer flask with lid
- Jar test apparatus
- Silica dish 250 ml, Hot plate
- Turbidity meter
- Conductivity meter
- $P^H$ meter
- Spectrometer
- 2L Beaker

### Lab Assessment

| Sl. No. | Rubrics (Sample) | Marks | | |
|---|---|---|---|---|
| | | High 5-4 | Medium 3-2 | Low 1-0 |
| **Conduction of experiment (Software)** | | | | |
| 1. | Chemical Handling | Proper , Safest way of Chemical Handling & Usage of PPE | Minimum usage of Proper , Safest way to Chemical Handling & Usage of PPE | Safe less & Easiest way of Chemical Handling without using PPE |
| 2. | Accuracy of titration Results | All the steps are followed correct sequence of Chemical addition & The speed of | Some steps are followed correct sequence of Chemical addition & The | Steps are not followed to sequence of Chemical addition & The speed of |

| | | | | |
|---|---|---|---|---|
| | | titration | speed of titration | titration |
| 3. | Presentation of results | Accurate results & Calculation. Neatly presented | Complete and neatly presented, Minor mistakes in Result & Calculation | Incomplete results, Mistakes in Calculation Sequence |
| 4 | Viva | Almost all the questions are answered. | Partially answered | Unable to answer. |
| 5 | Promptness | The experiment is Completed on time. Observation/Record note is submitted on time | The experiment is completed on time but the Observation / Record note is not submitted on time. | The experiment is not completed on time. Observation / Record note is not submitted on time. |
| | Mark Allocation | 25-20 | 15-10 | 5-0 |

## 5F5210 - Unit Operations Laboratory

Programme Name : DIPLOMA IN PAPER TECHNOLOGY

Course Code : 5F5210

Term : V

Course Name : Unit Operations Laboratory

### TEACHING AND SCHEME OF EXAMINATION

No of weeks per semester: 16 weeks

| Course | Instructions | | Examination | | | |
|---|---|---|---|---|---|---|
| | Hours / Week | Hours / Term | Marks | | | Duration |
| | | | Internal Assessment | Autonomous Examination | Total | |
| Unit Operations Laboratory | 4 | 64 | 25 | 100* | 100 | 3 Hrs. |

*** Examinations will be conducted for 100 marks and it will be reduced to 75 marks.**

**RATIONALE**

It gives the student knowledge of working of individual mechanical operations and their significance in chemical industries. With this information student can control the operation of equipment and regulate production.

**OBJECTIVES**

After completing all the experiments in the laboratory the student will be able to

- Determine the screen efficiency of a set of a set of sieves.
- Determine the specific cake resistance and filter medium resistance in a leaf filter.
- Centrifuge a given sample of slurry in a centrifuge
- Determine the viscosity of given liquid using stokes law
- Determine batch settling characteristics of a slurry & fluidized bed operation

**Course Outcomes:**

| Course outcome | | BTL |
|---|---|---|
| **CO1** | Know the characteristics of filtration and settling of calcium carbonate | **R** |
| **CO2** | Separate different sized solid particles using a set of sieve | **A** |
| **CO3** | Determine the heat transfer coefficient of Open pan evaporator | **A** |
| **CO4** | Determine the drying characteristics of wet solids inside drying chamber | **A** |
| **CO5** | Determine the operation efficiency of a given Ball mill setup | **U** |

## Mapping Course Outcomes (CO) - Program Outcomes (PO)

| CO | Program Outcomes (PO) | | | | | | | Program Specific Outcomes (PSO) | |
|---|---|---|---|---|---|---|---|---|---|
| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PSO1 | PSO2 |
| CO1 | | | | | | | | | |
| CO2 | | | | | | | | | |
| CO3 | | | | | | | | | |
| CO4 | | | | | | | | | |
| CO5 | | | | | | | | | |
| TOTAL | | | | | | | | | |
| No. of COs Mapping with POs | | | | | | | | | |
| Average | | | | | | | | | |
| Round off(Average) | | | | | | | | | |
| Correlation | | | | | | | | | |
| Strong – S / 3 | | | Medium – M /2 | | | | Weak – W / 1 | | |

## DETAILED SYLLABUS

Contents: Practical

**Name of the Topics:**

**Exercise**

1. To study the settling characteristics of calcium carbonate slurries of two different concentrations and plot graphs and make inferences
2. Determination of viscosity of water by making it flow through a capillary tube of known length and diameter
3. Analyze a feed by separating it into different sized solid particles using a set of sieve
4. Determination of viscosities of different free flowing liquid samples using an Ostwald's viscometer
5. To study the Filtration characteristics of calcium carbonate slurry (using a vacuum leaf filter) by low & high pressure filtration and plot graphs and make inferences.
6. Determination of Overall heat transfer coefficient 'U' of an open pan evaporator set-up with continuous stirring of the bath liquid.
7. To study the drying characteristics of a wet solid by drying it in a current of air inside a drying chamber, and plot graphs and make interfaces.
8. Determination of LMTD and Overall heat transfer coefficient of water – air system.
9. Determination of steam required to distilled unit samples of Aniline sample
10. Determination of percentage recovery of sodium hydroxide from its admixture with sand by single stage leaching to understand the principles behind leaching operation.
11. Ball Mill and operation efficiency

**Experiment Plan:**

| Module No. | Week No. | Experiments Name | Course Outcome | Weightage |
|---|---|---|---|---|
| | 3 | To study the settling characteristics of calcium carbonate slurries of two different concentrations and plot graphs and make inferences | | |
| | 4 | Determination of viscosity of water by making it flow through a capillary tube of known length and diameter | | |
| | 5 | Analyze a feed by separating it into different sized solid particles using a set of sieve | | |
| | 6 | Determination of viscosities of different free flowing liquid samples using an Ostwald's viscometer | | |
| | 7 | To study the Filtration characteristics of calcium carbonate slurry (using a vacuum leaf filter) by low & high pressure filtration and plot graphs and make inferences. | | |
| | 8 | Determination of Overall heat transfer coefficient 'U' of an open pan evaporator set-up with continuous stirring of the bath liquid. | | |
| | 9 | To study the drying characteristics of a wet solid by drying it in a current of air inside a drying chamber, and plot graphs and make interfaces. | | |
| | 10 | Determination of LMTD and Overall heat transfer coefficient of water – air system. | | |
| | 11 | Determination of steam required to distilled unit samples of Aniline sample | | |
| | 12 | Determination of percentage recovery of sodium hydroxide from its admixture with sand | | |

| | | | | |
|---|---|---|---|---|
| | | by single stage leaching to understand the principles behind leaching operation. | | |
| | 13 | Ball Mill and operation efficiency | | |

**Lab Assessment**

| Sl. No. | Rubrics (Sample) | Marks | | |
|---|---|---|---|---|
| | | **High 5-4** | **Medium 3-2** | **Low 1-0** |
| **Conduction of experiment (Software)** | | | | |
| 1. | Equipment Handling | Proper , Safest way of Equipment Handling & Usage of PPE | Minimum usage of Proper , Safest way to Equipment Handling & Usage of PPE | Safe less & Easiest way of Equipment Handling without using PPE |
| 2. | Accuracy of titration Results | All the steps are followed correct sequence of Procedure | Some steps are followed correct sequence of Procedure | Steps are not followed to sequence of Procedure |
| 3. | Presentation of results | Accurate results & Calculation. Neatly presented | Complete and neatly presented, Minor mistakes in Result & Calculation | Incomplete results, Mistakes in Calculation Sequence |
| 4 | Viva | Almost all the questions are answered. | Partially answered | Unable to answer. |
| 5 | Promptness | The experiment is Completed on time. Observation/Record note is submitted on time | The experiment is completed on time but the Observation / Record note is not submitted on time. | The experiment is not completed on time. Observation / Record note is not submitted on time. |
| | Mark Allocation | 25-20 | 15-10 | 5-0 |

## 5F5211 - ENVIRONMENTAL ENGINEERING LABORATORY

Programme Name : DIPLOMA IN PAPER TECHNOLOGY

Course Code : 5F5211

Term : V

Course Name : ENVIRONMENTAL ENGINEERING LABORATORY

### TEACHING AND SCHEME OF EXAMINATION

No of weeks per semester: 16 weeks

| Course | Instructions | | Examination | | | |
|---|---|---|---|---|---|---|
| | Hours / Week | Hours / Term | Marks | | | Duration |
| | | | Internal Assessment | Autonomous Examination | Total | |
| ENVIRONMENTAL ENGINEERING LAB | 4 | 64 | 25 | 100* | 100 | 3 Hrs. |

*** Examinations will be conducted for 100 marks and it will be reduced to 75 marks.**

**RATIONALE:**

Students will be given the idea of various processes to measurement of Temperature using Thermocouple module, RTD module, and pressure using strain gauge type Transducer, dead weight tester. The status of Indian industries in relation to pulp making should be imparted to them. The use of pulp for various types of papermaking should also be emphasized.

**OBJECTIVES:**

After completion of this practical, the student should be able to construct

- To know the measurement of Temperature
- To know the measurement of pressure
- To know the basic definition and standard terms used in pulp and paper industries Calibration of pressure gauges, Liquid level ON – OFF Control, Demonstration of flow rate control
- To know the types of P, PI control, PID Control using PID controller Trainer Kit
- To know the characteristics of flow control valve and temperature ON – OFF Control
- To know the analysis of instrumentation Failure and Linear variable Differential Transformer Module

**Course Outcomes:**

| Course outcome | | BTL |
|---|---|---|
| **CO1** | Determine COD, BOD & DO in water samples | **R** |
| **CO2** | Determine $P^H$, Electrical conductivity, acidity, alkalinity & Turbidity of given water sample | **A** |
| **CO3** | Determine solid contents | **A** |
| **CO4** | Determine break point chlorination for the given water sample | **A** |
| **CO5** | Find amount of optimum coagulant dosage needed for the given water sample | **U** |

## Mapping Course Outcomes (CO) - Program Outcomes (PO)

| CO | Program Outcomes (PO) | | | | | | | Program Specific Outcomes (PSO) | |
|---|---|---|---|---|---|---|---|---|---|
| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PSO1 | PSO2 |
| CO1 | | | | | | | | | |
| CO2 | | | | | | | | | |
| CO3 | | | | | | | | | |
| CO4 | | | | | | | | | |
| CO5 | | | | | | | | | |
| TOTAL | | | | | | | | | |
| No. of COs Mapping with POs | | | | | | | | | |
| Average | | | | | | | | | |
| Round off(Average) | | | | | | | | | |
| Correlation | | | | | | | | | |
| Strong – S / 3 | | | Medium – M /2 | | | | Weak – W / 1 | | |

## DETAILED SYLLABUS

Contents: DEPARTMENT PAPER TECHNOLOGY

**NAME OF THE TOPICS: Process Instrumentation & Control Practical**

**Exercise:**

1. Determination of chemical oxygen demand (COD).
2. Determination of dissolved oxygen (D.O)
3. Determination of biological oxygen demand (BOD)
4. Estimation of optimum coagulant dosage
5. Determination of solids (TSS & TDS)
6. Determination of the Turbidity, Electrical Conductivity and pH of the given sample
7. Determination of acidity in process water,
8. Determination of alkalinity in process water.
9. Analysis of ions: copper, chlorides and sulfate
10. Determination of break point chlorination

**Experiment Plan:**

| Module No. | Week No. | Experiments Name | Course Outcome | Weightage |
|---|---|---|---|---|
| 1 | 3 | Determination of chemical oxygen demand (COD). | | |
| 2 | 4 | Determination of dissolved oxygen (D.O) | | |
| 3 | 5 | Determination of biological oxygen demand (BOD) | | |
| 4 | 6 | Estimation of optimum coagulant dosage | | |
| 5 | 7 | Determination of solids (TSS & TDS) | | |
| 6 | 8 | Determination of the Turbidity, Electrical Conductivity and pH of the given sample | | |
| 7 | 9 | Determination of acidity in process water, | | |
| 8 | 10 | Determination of alkalinity in process water. | | |
| 9 | 11 | Analysis of ions: copper, chlorides and sulfate | | |
| 10 | 12 | Determination of break point chlorination | | |

## LIST OF EQUIPMENTS

- Conical flasks 250 ml
- Burners
- Tripod stand and wire gauze
- Burette stand with clamp
- Burettes 50 ml
- Pipettes 5ml, 10ml, 20ml, 25ml
- Funnels
- DO Meter And DO testing kit
- BOD incubator Erlenmeyer flask with lid
- Jar test apparatus
- Silica dish 250 ml, Hot plate
- Turbidity meter
- Conductivity meter
- $P^H$ meter
- Spectrometer
- 2L Beaker

**Lab Assessment**

| Sl. No. | Rubrics (Sample) | Marks | | |
|---|---|---|---|---|
| | | **High 5-4** | **Medium 3-2** | **Low 1-0** |
| **Conduction of experiment (Software)** | | | | |
| 1. | Chemical Handling | Proper , Safest way of Chemical Handling & Usage of PPE | Minimum usage of Proper , Safest way to Chemical Handling & Usage of PPE | Safe less & Easiest way of Chemical Handling without using PPE |
| 2. | Accuracy of titration Results | All the steps are followed correct sequence of Chemical addition & The speed of titration | Some steps are followed correct sequence of Chemical addition & The speed of titration | Steps are not followed to sequence of Chemical addition & The speed of titration |
| 3. | Presentation of results | Accurate results & Calculation. Neatly presented | Complete and neatly presented, Minor mistakes in Result & Calculation | Incomplete results, Mistakes in Calculation Sequence |
| 4 | Viva | Almost all the questions are answered. | Partially answered | Unable to answer. |
| 5 | Promptness | The experiment is Completed on time. Observation/Record note is submitted on time | The experiment is completed on time but the Observation / Record note is not submitted on time. | The experiment is not completed on time. Observation / Record note is not submitted on time. |
| | Mark Allocation | 25-20 | 15-10 | 5-0 |

## 5F5403 - PROCESS INSTRUMENTATION AND CONTROL LABORATORY

Programme Name : DIPLOMA IN PAPER TECHNOLOGY

Course Code : 5F5403

Term : V

Course Name : Process Instrumentation & Control Laboratory

### TEACHING AND SCHEME OF EXAMINATION

No of weeks per semester: 16 weeks

| Course | Instructions | | Examination | | | |
|---|---|---|---|---|---|---|
| | Hours / Week | Hours / Term | Marks | | | Duration |
| | | | Internal Assessment | Autonomous Examination | Total | |
| PROCESS INSTRUMENTATION & CONTROL LABORATORY | 4 | 64 | 25 | 100* | 100 | 3 Hrs. |

*** Examinations will be conducted for 100 marks and it will be reduced to 75 marks.**

**RATIONALE:**

Students will be given the idea of various processes to measurement of Temperature using Thermocouple module, RTD module, and pressure using strain gauge type Transducer, dead weight tester. The status of Indian industries in relation to pulp making should be imparted to them. The use of pulp for various types of papermaking should also be emphasized.

**OBJECTIVES:**

After completion of this practical, the student should be able to construct

- To know the measurement of Temperature
- To know the measurement of pressure
- To know the basic definition and standard terms used in pulp and paper industries Calibration of pressure gauges, Liquid level ON – OFF Control, Demonstration of flow rate control
- To know the types of P, PI control, PID Control using PID controller Trainer Kit
- To know the characteristics of flow control valve and temperature ON – OFF Control
- To know the analysis of instrumentation Failure and Linear variable Differential Transformer Module

**Course Outcomes:**

| Course outcome | | BTL |
|---|---|---|
| **CO1** | Measure temperature using Thermocouple & RTD module | **A** |
| **CO2** | Measure pressure using Strain gauge, Bourdon tube & Dead weight Gauge | **A** |
| **CO3** | Control liquid level & Temperature On – Off controller | **A** |
| **CO4** | Control P, PI, PID using PID Controller trainer Kit | **A** |
| **CO5** | Know the application of LVDT in various flow control equipments | **R** |

**Mapping Course Outcomes (CO) - Program Outcomes (PO)**

| CO | Program Outcomes (PO) | | | | | | | Program Specific Outcomes (PSO) | |
|---|---|---|---|---|---|---|---|---|---|
| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PSO1 | PSO2 |
| CO1 | | | | | | | | | |
| CO2 | | | | | | | | | |
| CO3 | | | | | | | | | |
| CO4 | | | | | | | | | |
| CO5 | | | | | | | | | |
| TOTAL | | | | | | | | | |
| No. of COs Mapping with POs | | | | | | | | | |
| Average | | | | | | | | | |
| Round off(Average) | | | | | | | | | |
| Correlation | | | | | | | | | |
| Strong – S / 3 | | | Medium – M /2 | | | | Weak – W / 1 | | |

## DETAILED SYLLABUS

Contents: DEPARTMENT PAPER TECHNOLOGY

**NAME OF THE TOPICS: Process Instrumentation & Control Practical Exercise:**

1. Measurement of Temperature using Thermocouple and RTD module's
2. Measurement of Pressure using Strain Gauge type Transducer
3. Measurement of Pressure using Bourdon pressure transducer
4. Calibration of pressure gauges using Dead weight Tester
5. Liquid level ON-OFF Control
6. Demonstration of flow rate control using Alarm Circuit
7. P,PI,PID Control using PID Controller Trainer Kit
8. Characteristics of flow control valve
9. Temperature ON-OFF Control
10. Linear variable Differential Transformer Module

**Experiment Plan:**

| Module No. | Week No. | Experiments Name | Course Outcome | Weightage |
|---|---|---|---|---|
| 1 | 3 | Measurement of Temperature using Thermocouple and RTD module's | | |
| 2 | 4 | Measurement of Pressure using Strain Gauge type Transducer | | |
| 3 | 5 | Measurement of Pressure using Bourdon pressure transducer | | |
| 4 | 6 | Calibration of pressure gauges using Dead weight Tester | | |
| 5 | 7 | Liquid level ON-OFF Control | | |
| 6 | 8 | Demonstration of flow rate control using Alarm Circuit | | |
| 7 | 9 | P,PI,PID Control using PID Controller Trainer Kit | | |
| 8 | 10 | Characteristics of flow control valve | | |
| 9 | 11 | Temperature ON-OFF Control | | |
| 10 | 12 | Linear variable Differential Transformer Module | | |

## LIST OF EQUIPMENTS

- Thermocouple
- Resistance temperature detector
- Strain gauge transducer
- Bourdon tube pressure gauge calibrator setup
- Dead weight pressure gauge
- Level transmitter
- Flow rate control alarm circuit
- P, PI and PID Controller Trainer Kit
- Pneumatic control valve
- Temperature On – Off controller with sensor
- LVDT

**Lab Assessment**

| Sl. No. | Rubrics (Sample) | Marks | | |
|---|---|---|---|---|
| | | **High 5-4** | **Medium 3-2** | **Low 1-0** |
| **Conduction of experiment (Software)** | | | | |
| 1. | Coding Skill | Show excellent understanding of the logic. The code is correct with regard to syntax. | Show minimal understanding of the logic. But the code has several syntax errors | Show no understanding of the logic and unable to write the code |
| 2. | Simulation steps / Debugging capacity | All the steps are followed correct sequence. Knows how to debug the error. . | Some steps are followed but error occurred. Debugged the error with the guidance. | Steps are not followed . Not showing interest to debug the error. |
| 3. | Presentation of results | Complete and accurate results, Neatly presented | Complete and neatly presented, Minor mistakes | Incomplete results, Major mistakes |
| 4 | Viva | Almost all the questions are answered. | Partially answered | Unable to answer.. |
| 5 | Promptness | The experiment is completed on time. Observation/Record note is submitted on time . | The experiment is completed on time but the Observation / Record note is not submitted on time. | The experiment is not completed on time. Observation / Record note is not submitted ontime. |
| | Mark Allocation | 25-20 | 15-10 | 5-0 |

## 5F0006 - UNIVERSAL HUMAN VALUES

Programme Name : DIPLOMA IN PAPER TECHNOLOGY.

Course Code : 5F0006

Term : V

Course Name : Universal Human Values

**TEACHING AND SCHEME OF EXAMINATION**

No of weeks per semester: 16 weeks

| Subject | Instructions | | Examination | | | |
|---|---|---|---|---|---|---|
| | | | Marks | | | Duration |
| | Hours / Week | Hours / Semester | Internal Assessmen | Board Examination | Total | |
| Universal Human Values | 5 | 80 | 25 | 100* | 100 | 3 Hrs. |

*** Examinations will be conducted for 100 marks and it will be reduced to 75 marks.**

**OBJECTIVES:**

1. To help students distinguish between values and skills, and understand the need, basic guidelines, content and process of value education.
2. To help students initiate a process of dialog within themselves to know what they ‘really want to be’ in their life and profession
3. To help students understand the meaning of happiness and prosperity for a Human being.
4. To understanding the moral values that ought to guide engineering profession or practice, resolving moral issues in engineering, and justifying the moral judgments in engineering.
5. To understand the concept of values, meaning of stress, various causes of stress and to manage stress.

## Course Outcome

**On successful completion of the course, the students will be able to attain below Course Outcome (CO):**

| Course outcome | | BTL |
|---|---|---|
| **CO1** | Understand the significance of value inputs in a classroom and start applying them in their life and profession. | **U** |
| **CO2** | Distinguish between values and skills, happiness and accumulation of physical facilities, the Self and the Body, Intention and Competence of an individual, etc. | **U** |
| **CO3** | Understand the value of harmonious relationship based on trust and respect in their life and Profession. | **U** |
| **CO4** | To facilitate the students in applying the understanding of harmony in existence in their profession and lead an ethical life. | **U** |
| **CO5** | To understand the individual and organizational strategies to manage stress. | **U** |

**Legends:** R = Remember U= Understand; A= Apply and above levels (BTL-Bloom's revised taxonomy Level)

**Mapping Course Outcomes (CO) - Program Outcomes (PO)**

| CO | Program Outcomes (PO) | | | | | | | Program Specific Outcomes (PSO) | |
|---|---|---|---|---|---|---|---|---|---|
| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PSO1 | PSO2 |
| CO1 | 2 | 2 | 1 | 2 | - | - | - | - | - |
| CO2 | 2 | 2 | 1 | 2 | - | - | - | - | - |
| CO3 | 2 | 2 | 1 | 2 | - | - | - | - | - |
| CO4 | 3 | 2 | 1 | 3 | - | - | - | - | - |
| CO5 | 2 | 2 | 1 | 2 | - | - | - | - | - |
| TOTAL | 11 | 10 | 5 | 11 | - | - | - | - | - |
| No. of COs Mapping with POs | 5 | 5 | 5 | 5 | - | - | - | - | - |
| Average | 2.2 | 2 | 1 | 2.2 | - | - | - | - | - |
| Round off(Average) | 2 | 2 | 1 | 2 | - | - | - | - | - |
| Correlation | | | | | | | | | |
| Strong – S / 3 | | | Medium – M /2 | | | | Weak – W / 1 | | |

## DETAILED SYLLABUS

Contents: Universal Human Values

| Unit | Name of the Topics | Hours |
|---|---|---|
| I | **COURSE INTRODUCTION - NEED, BASIC GUIDELINES, CONTENT AND PROCESS FOR VALUE EDUCATION**<br>Purpose and motivation for the course, recapitulation from Universal Human Values-I - Self-Exploration – what is it? - Its content and process; 'Natural Acceptance' and Experiential Validation- as the process for self- exploration - Continuous Happiness and Prosperity- A look at basic Human Aspirations - Right understanding, Relationship and Physical Facility- the basic requirements for fulfilment of aspirations of every human being with their correct priority - Understanding Happiness and Prosperity correctly- A critical appraisal of the current scenario - Method to fulfil the above human aspirations: understanding and living in harmony at various levels. | 12 |
| II | **UNDERSTANDING HARMONY IN THE HUMAN BEING - HARMONY IN MYSELF**<br>Understanding human being as a co-existence of the sentient 'I' and the material 'Body'- Understanding the needs of Self ('I') and 'Body' - happiness and physical facility-Understanding the Body as an instrument of 'I' (I being the doer, seer and enjoyer)- Understanding the characteristics and activities of 'I' and harmony in 'I'- Understanding the harmony of I with the Body: Sanyam and Health; correct appraisal of Physical needs, meaning of Prosperity in detail- Programs to ensure Sanyam and Health. | 12 |
| III | **UNDERSTANDING HARMONY IN THE FAMILY AND SOCIETY- HARMONY IN HUMAN - HUMAN RELATIONSHIP**<br>Understanding values in human-human relationship; meaning of Justice (nine universal values in relationships) and program for its fulfilment to ensure mutual happiness; Trust and Respect as the foundational values of relationship- Understanding the meaning of Trust; Difference between intention and competence- Understanding the meaning of Respect, Difference between respect and differentiation; the other | 11 |

| | | |
|---|---|---|
| | salient values in relationship-Understanding the harmony in the society (society being an extension of family): Resolution, Prosperity, fearlessness (trust) and co-existence as comprehensive Human Goals- Visualizing a universal harmonious order in society- Undivided Society, Universal Order- from family to world family. | |
| IV | **PERSONALITY DEVELOPMENT AND LEADERSHIP**<br>Introduction- Personality- Character- Determinants of Personality and Character Development - Measures to Develop the Personality – Measures to Improve Character – leadership - leadership traits Senses of engineering -Variety of moral issues-Types of inquiries - Moral dilemma -Moral autonomy -Moral development (theories)- Consensus and controversy -Profession -Models of professional roles-Responsibility - Theories about right action (Ethical theories)- control -Self-interest – Customs -Religion -Self-respect -Case study: Choice of the theory | 11 |
| V | **STRESS MANAGEMENT**<br>Characteristics of Values- Meaning- Sources of Value Formation: Social institutions, Organisation, Colleagues, Work Need of studying values, Need for Studying Values- Stress -Meaning and Definition- Nature of Stress- Stress Level and Its Impacts- Causes of Stress- Stress Management- Individual Approaches- Organizational Approaches. | 11 |

**ASSESSMENT**:

- This is a compulsory credit course. The assessment is to provide a fair state of development of the student, so participation in classroom discussions, etc. will be used in evaluation.

**Example:**

- Assessment by faculty mentor: 10 marks
- Socially relevant project/Group Activities/Assignments: 15 marks
- Semester End Examination: 100 marks
- Question Pattern for End semester is 50 MCQ.
- Each question carries 2 points ( 10 MCQ’s from Each Unit)
- The overall pass percentage is 40%.

**Reference Books**


1. Human Values, A.N. Tripathi, New Age Intl. Publishers, New Delhi, 2004.
2. The Story of Stuff (Book).
3. Small is Beautiful - E. F Schumacher.
4. Slow is Beautiful - Cecile Andrews
5. Economy of Permanence - J C Kumarappa
6. Bharat Mein Angreji Raj - PanditSunderlal
7. Rediscovering India - by Dharampal
8. Hind Swaraj or Indian Home Rule - by Mohandas K. Gandhi
9. India Wins Freedom - Maulana Abdul Kalam Azad
10. Vivekananda - Romain Rolland (English)
11. IES Master Institute of Enginee

## 5F6306 - Chemical Recovery

Programme Name : DIPLOMA IN PAPER TECHNOLOGY.

Course Code : 5F6306

Term : VI

Course Name : CHEMICAL RECOVERY

### TEACHING AND SCHEME OF EXAMINATION

No of weeks per semester: 16 weeks

| Course | Instructions | | Examination | | | |
|---|---|---|---|---|---|---|
| | Hours / Week | Hours / Term | Marks | | | Duration |
| | | | Internal Assessment | Autonomous Examination | Total | |
| CHEMICAL RECOVERY | 4 | 64 | 25 | 100* | 100 | 3 Hrs. |

*** Examinations will be conducted for 100 marks and it will be reduced to 75 marks.**

### Topics and Allocation of Hours

| UNIT | Topic | Hrs. |
|---|---|---|
| I | Objective of Chemical Recovery | 15 |
| II | Silica Removal Of Black Liquor | 14 |
| III | Salt Cake make-up-modern Chemical Recovery Unit | 15 |
| IV | Smelt | 14 |
| V | Causticizing | 15 |
| Test & Model Exam | | 7 |
| **Total** | | 80 |

**RATIONALE**

The subject is mainly to impart knowledge of chemical recovery from kraft pulp mill liquor. By recovery those chemical of reuse the same in to process will save energy and the pollution is controlled.

**OBJECTIVE**

Student will be able to know

- The chemical recovery in a kraft pulp mill operating techniques and instrumentation methods.
- The silica removal methods practiced in kraft mill from black liquor and green liquor. Merits and demerits of silica removal. The advantages of silica removal from black liquor
- The modern chemical recovery unit the units are Furnace, boiler, super Heater and economizer.
- The clarification of raw green liquor and smelt dissolution. Types of the slacker, clarification of raw green liquor and washer
- Modern trends in chemical recovery of a kraft mill
- Know about lime kiln and it’s operations.

## Course Outcome

***On successful completion of the course, the students will be able to attain below Course Outcome (CO):***

| Course outcome | | BTL |
|---|---|---|
| **CO1** | Understand the basic concepts of chemical recovery in pulp mill | **R** |
| **CO2** | Understand the silica removal methods of black liquor | **A** |
| **CO3** | Understand about the principle, construction & working of recovery boiler | **A** |
| **CO4** | Understand the conversion process of green liquor to white liquor | **A** |
| **CO5** | Know about the chemistry of causticizing & their troubleshootings in plant | **U** |

**Legends:** R = Remember U= Understand; A= Apply and above levels (BTL-Bloom's revised taxonomy Level)

**Course-PO Attainment Matrix**

| CO | Program Outcomes (PO) | | | | | | | Program Specific Outcomes (PSO) | |
|---|---|---|---|---|---|---|---|---|---|
| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PSO1 | PSO2 |
| CO1 | | | | | | | | | |
| CO2 | | | | | | | | | |
| CO3 | | | | | | | | | |
| CO4 | | | | | | | | | |
| CO5 | | | | | | | | | |
| TOTAL | | | | | | | | | |
| No. of COs Mapping with POs | | | | | | | | | |
| Average | | | | | | | | | |
| Round off(Average) | | | | | | | | | |
| Correlation | | | | | | | | | |
| Strong – S / 3 | | | Medium – M /2 | | | | Weak – W / 1 | | |

*Method is to relate the level of PO with the number of hours devoted to the COs which address the given PO.*

- If ≥40% of classroom sessions addressing a particular PO, it is considered that PO is addressed at Level 3
- If 25 to 40% of classroom sessions addressing a particular PO, it is considered that PO is addressed at Level 2
- If 5 to 25% of classroom sessions addressing a particular PO, it is considered that PO is addressed at Level 1
- If < 5% of classroom sessions addressing a particular PO, it is considered that PO is considered not-addressed.

## DETAILED SYLLABUS

Contents: Theory

| Unit | Name of the Topics | Hours |
|---|---|---|
| I | **OBJECTIVE OF CHEMICAL RECOVERY**<br>**Chapter 1.1 -** Objectives of Chemical recovery in a Kraft pulp mill – Various steps involved of Kraft liquor recovery and reuse – Black liquor – Properties of black liquor-Multiple effect evaporation of black liquor – Falling film and Forced circulation evaporators (brief description of each with schematic sketches) – Simple numerical on material balance relating to black liquor evaporation in multiple effect evaporator plant. (formulae for material balance to be stated. No derivations required).<br>**Chapter 1.2 -** Standard terms used in a Kraft recovery plant and simple numerical based on them – Direct contact evaporation of semi concentrated black liquor-Cascade evaporator, Cyclone evaporator and Venturi evaporator cum scrubber. | 15 |
| II | **SILICA REMOVAL OF BLACK LIQUOR**<br>**Chapter 2.1 -** Electro Static Precipitation Of Fume In Kraft Recovery Plant – Its Principle Of Working And Operation Silica removal methods practiced in Kraft mill from black liquor and green liquor- Advantages of silica removal –Chemical equations and operations involved in silica removal.<br>**Chapter 2.2 -** Oxidation of black liquor – Advantages – Chemical equations involved – Oxidation equipment namely Spiral oxidizer. | 14 |
| III | **SALT CAKE MAKE-UP-MODERN CHEMICAL RECOVERY UNIT**<br>**Chapter 3.1 -** Recovery boiler-Super heater Economizer – Air heater-Saltcake mix tank-Smelt dissolving tank-Air fan-Soot blowers and their working.<br>**Chapter 3.2 -** Black liquor incineration – Different zones inside the furnace –functions and changes taking place inside the furnace-Explosion Hazards and common troubles associated with the Recovery furnace and allied equipments – Chemistry involved at the various stages of recovery and reuse of kraft spent liquor – Stack emission control | 15 |

| | | |
|---|---|---|
| IV | **SMELT**<br>**Chapter 4.1 -** Smelt dissolution – Raw Green liquor – Clarification of raw green liquor – Dregs and its washing – Slaking of green liquor-Stationary slaker cum classifier – Rotary slaker and classifier – Grits and its washing-Causticising tanks-Raw white liquor-Clarification of whit liquor – Unit type -Lime mud washing – Unit type and Balanced compartmental tray type mud washers-Lime mud dewatering – Rotary drum vacuum filter and Belt filters.<br>**Chapter 4.2 -** Make up lime and lime stone- -Desilication of lime sludge-Partial Causticising – Rotary lime kiln – Construction and Operation – Burning of lime mud – Different zones and their functions and temperatures inside the kiln. Fluidised bed calcinations system. | 14 |
| V | **CAUSTICIZING**<br>**Chapter 5.1 -** Chemistry of Causticising – Causticising efficiency – Factors influencing it – Reasons for incomplete Causticising – simple numerical on Causticising efficiency – Sodium, Sulphur and Calcium losses – Reduction efficiency in furnace – Available calcium oxide from kiln. Trouble shooting in Causticising plant. | 15 |

**Reference Books**


1 Hand book of pulp and paper technology Kenneth W. Britt CBS Publishers

2 pulp and paper manufacture volume I Ronald G. Mc Donald McGraw - Hill

3 pulp and paper volume I and II James P. Casey Academic Press

4 Pulping process Sven A. Rydholm Inter science publisher

5 Chemical recovery in alkaline pulping processes TAPPI monograph series No.32 Tappi Publicationd

6 Hand book for pulp and paper technologies G.A. Smook Angus wilde publications

## 5F6307 - Pulp and Paper Technology III

Programme Name : DIPLOMA IN PAPER TECHNOLOGY.

Course Code : 5F6307

Term : VI

Course Name : PULP & PAPER TECHNOLOGY – III

### TEACHING AND SCHEME OF EXAMINATION

No of weeks per semester: 16 weeks

| Course | Instructions | | Examination | | | |
|---|---|---|---|---|---|---|
| | Hours / Week | Hours / Term | Marks | | | Duration |
| | | | Internal Assessment | Autonomous Examination | Total | |
| PULP & PAPER TECHNOLOGY – III | 5 | 80 | 25 | 100* | 100 | 3 Hrs. |

*** Examinations will be conducted for 100 marks and it will be reduced to 75 marks.**

### Topics and Allocation of Hours

| UNIT | Topic | Hrs. |
|---|---|---|
| I | Sheet formation | 15 |
| II | Modern developments in sheet formation & cylinder machines | 14 |
| III | Pressing | 15 |
| IV | Drying | 14 |
| V | Calendaring & Coating | 15 |
| Test & Model Exam | | 7 |
| **Total** | | 80 |

**RATONALE**

Most of the pulp & paper industry will involve some operations. The pulp mill operations are washing, screening, centricleaning, bleaching. The paper machine operations are headbox, press and principles of drying. Therefore, it's necessary to have good understanding about the pulp and paper equipments – Diagram and description, Bleaching with a reducing agent common and special qualities and their characteristics of paper including industrial papers and electrical grade papers such as conduction, convection. These methods can be used for understanding the performances of equipment used in almost all chemical and related industries.

**OBJECTIVE**

At the end of this course, students will be able to Know

- Sheet formation single wire Fourdriner machines, Twin & multilayer wire systems, operation of wire part, various parts on wire part, water drainage and sheet formation on forming fabric,construction of wire table and various supporting roll, operation and control of wire part.
- Water removal by wet pressing Sheet consolidation various press design.
- Role of press fabric theory of pressing felt/ Fabric conditioning and cleaning.
- The principles of drying. The description of multi cylinder and yankee cylinder.
- The super calendaring, construction of super calendar and its description
- The principles of cylinder machines., Diagram and description of the two types of vat flows piping system. The common troubles of cylinder mould machines…
- The coating chemicals and typical formulation Air knife coater – Flexible blade coaters and a simple sketch. Application and advantages of curtain coater
- Know the modern development in sheet formation. The different types of sheet formation. To know the finishing of paper.

## Course Outcome

***On successful completion of the course, the students will be able to attain below Course Outcome (CO):***

| Course outcome | | BTL |
|---|---|---|
| **CO1** | Understand the process involved in sheet making | **R** |
| **CO2** | Know about modern developments in sheet formation & cylinder machines | **A** |
| **CO3** | Understand about the various press configuration | **A** |
| **CO4** | Understand the principle, working of different types of drying cylinder | **A** |
| **CO5** | Understand the process of calendaring & coating | **U** |

**Legends:** R = Remember U= Understand; A= Apply and above levels (BTL-Bloom's revised taxonomy Level)

**Course-PO Attainment Matrix**

| CO | Program Outcomes (PO) | | | | | | | Program Specific Outcomes (PSO) | |
|---|---|---|---|---|---|---|---|---|---|
| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PSO1 | PSO2 |
| CO1 | | | | | | | | | |
| CO2 | | | | | | | | | |
| CO3 | | | | | | | | | |
| CO4 | | | | | | | | | |
| CO5 | | | | | | | | | |
| TOTAL | | | | | | | | | |
| No. of COs Mapping with POs | | | | | | | | | |
| Average | | | | | | | | | |
| Round off(Average) | | | | | | | | | |
| Correlation | | | | | | | | | |
| Strong – S / 3 | | | Medium – M /2 | | | | Weak – W / 1 | | |

*Method is to relate the level of PO with the number of hours devoted to the COs which address the given PO.*

- *If ≥40% of classroom sessions addressing a particular PO, it is considered that PO is addressed at Level 3*
- *If 25 to 40% of classroom sessions addressing a particular PO, it is considered that PO is addressed at Level 2*
- *If 5 to 25% of classroom sessions addressing a particular PO, it is considered that PO is addressed at Level 1*
- *If < 5% of classroom sessions addressing a particular PO, it is considered that PO is considered not-addressed.*

## DETAILED SYLLABUS

Contents: Theory

| Unit | Name of the Topics | Hours |
|---|---|---|
| I | **SHEET FORMATION**<br>**Chapter 1.1 -** Definition of sheet formation and paper- Head box and its functions and important types- The three sections of Head box with a simple sketch- Types of distributors (simple type, tapered duct type with flow eveners. With fan pump, cross flow type, and multiple branch manifold- A simple sketch and description on each)- Middle section Types and functions of slices- Evaluation of pressure head in head box - Dilution control system – CFD formers<br>**Chapter 1.2 -** A complete description with a neat diagram of four driner wire part- Placement of stock on the wire sagging- Jet wire speed ratio and its significance- Dewatering at table rolls- Grooved table rolls- Couch and its types- The three types of transfer of web from couch to press part- Drainage at wire part VS hydraulic pres part gradient (Qualitative treatment only) – Shower water system | 15 |
| II | **MODERN DEVELOPMENTS IN SHEET FORMATION & CYLINDER MACHINES**<br>**Chapter 2.1 -** High speed machines – Twin Wire former – Top former & shaker – Inver form machines – Stevence former – Roto former – Hybrid former. A note on stretch in paper.<br>**Chapter 2.2 -** Principle of cylinder machines – Speed limitations – Disadvantages and advantages of cylinder machines – Factor affecting drainage – Diagram and description of the two types of vat flows with piping system – Primary press part of cylinder machines – Common troubles of cylinder mould machines. | 14 |
| III | **PRESSING**<br>**Chapter 3.1 -** The effect of pressing on sheet- Necessity of pressing- construction of press part- crowning of press(solid and suction presses)- A note on swimming roll with a neat diagram- theory of pressing (Wahistrom's theory only)- Factors affecting dewatering in pressing- Felt - Functions, constructions – Extended NIP press (Woven and needle | 15 |

| | | |
|---|---|---|
| | types only) and cleaning of press felts - some special types of presses(Brief notes on)<br>(i) Smoothening press<br>(ii) Air bleed press<br>(iii) Reverse or return press<br>(iv) Fabric press and<br>(v) Unipress<br>(vi) Shoe Press | |
| IV | **DRYING**<br>**Chapter 4.1 -** Introduction principles of drying – Cylinder drying its principles – A graphical sketch of drying for critical moisture content – Description of multi cylinders and Yankee cylinder Factor affecting drying – Drying efficiency in relation to mass and heat transfer- (A qualitative treatment only) – A note on too dry and too wet papers of drying process – Drying with blowers – Ventilation hoods – Steam and condensate systems – Dryer felts – Vacuum systems of paper machines. Syphonic systems for condensate and removal – advantages of Unirun dryers problems involving production of paper with quantity of water removal at wire part, press part and drying parts – Metering size press. | 14 |
| V | **CALENDARING & COATING**<br>**Chapter 5.1 -** Machine and supercalendering – Effect of calendaring on paper – Common terms – Spreader roll( a simple diagram and a note) – Crowing with reference to hot or cold air blowing anti deflection roll, bottom roll bending and swimming rolls – Construction of super calendar and its description – Creep-humidity during calendaring – Common calendar troubles – A short note on embossing and its two types (gear and slip embossing) – Paper machine reels and its common troubles. A qualitative treatment on paper machine drives – Broke handling system.<br>**Chapter 5.2 -** Aims of coating - coating chemicals and typical formulation – Starch preparation system – Coating color system – online & offline coating system - Air knife coater – Flexible blade coaters – A simple sketch and description of these coaters – | 15 |

| | | |
|---|---|---|
| | Rod/metering coater – its application and advantages curtain coater.<br>**Chapter 5.3 -** Winding and slitting – Rewinding – Sheet cutting and guillotines – Roll wrapping & Pallet Wrapping - Counting – Packing and dispatching Standard sizes of paper – Common and special qualities and their characteristics of paper including industrial papers and electrical grade papers.<br>**Chapter 5.4 -** Introduction to Industry 4.0 – Machine learning & Artificial intelligence | |

**Reference Books**


1 Hand book of pulp and paper technology Kenneth W. Britt CBS Publishers

2 pulp and paper volume I and II James P. Casey Academic Press

3 Pulping process Sven A. Rydholm Inter science publisher

4 Pulp and paper Manufacture I and II Ronald G Macdonald Wiley & Sons

## 5F6308 - Process Design Concept

Programme Name : DIPLOMA IN PAPER TECHNOLOGY.

Course Code : 5F6308

Term : VI

Course Name : Process Design Concept

### TEACHING AND SCHEME OF EXAMINATION

No of weeks per semester: 16 weeks

| Course | Instructions | | Examination | | | |
|---|---|---|---|---|---|---|
| | Hours / Week | Hours / Term | Marks | | | Duration |
| | | | Internal Assessment | Autonomous Examination | Total | |
| Process Design Concept | 5 | 80 | 25 | 100* | 100 | 3 Hrs. |

*** Examinations will be conducted for 100 marks and it will be reduced to 75 marks.**

### Topics and Allocation of Hours

| UNIT | Topic | Hrs. |
|---|---|---|
| I | Pulping mill | 15 |
| II | Secondary fibre Procesing | 14 |
| III | Paper Machine | 15 |
| IV | Recovery plant and their equipments. | 14 |
| V | Paper making & Recovery material balance | 15 |
| | Test & Model Exam | 7 |
| | **Total** | 80 |

**RATIONALE**

Most of the pulp & paper making process will involve more equipment. Hence the knowledge about design criteria and parameters of equipment are needed. It is, therefore, extremely necessary to have good understanding about the equipment design. The environmental pollution mechanisms such as air pollution, water pollution, land pollution noise pollution and it's controls process. These methods can be used for understanding the performances of equipment used in almost all chemical and related industries.

**OBJECTIVE**

At the end of this course, students will be able to know

- The different equipments used in pulp and paper making processes. The Mixing and agitation equipments, clarifiers
- The design criteria and parameters of pulp mill equipments
- The criteria and parameters of recovery and paper machine design
- The pollution control standards for air sources of air pollution, Analytical methods of air pollution, measurement of important air pollutants
- For control of air pollutants as applicable to pulp and paper industries Dust collectors, cyclone seperators, raw water clarification and water treatment
- The pollution control standards for water pollution, industrial waste treatment as applied to paper industry, water conservation methods of BOD and COD
- The land pollution, sources and classification of solid wastes, solid wastes generated from various units of paper mill.,
- The ecology and ecosystem, carbon monoxide and carbon dioxide discharges into atmosphere, global warming, ozone layer depletion, nuclear radiation. Methods being taken up and suggested to cleanup and suggested to cleanup environment for a pollution free planet of the future

## Course Outcome

***On successful completion of the course, the students will be able to attain below Course Outcome (CO):***

| Course outcome | | BTL |
|---|---|---|
| **CO1** | Understanding of Material Balance – Pulp mill Digestor, Brown stock washer, Bleaching | **U** |
| **CO2** | Identify of Deinking (Flotation cell) & Low consistency Pulper | **R** |
| **CO3** | Understanding of Material Balance – Paper machine, identify Stock preparation Headbox – Capacity, Fanpump, pipe size Disc refiner, Centri – cleaner & Screening | **A** |
| **CO4** | Identify of Drying section, No of Dryers, Area of contact, Angle of wrap, Consistency of Pulp at various stages in Wire part and there effects.Wire length &width, Dandy roll | **U** |
| **CO5** | Understanding of Production calculation for paper mill | **A** |

**Legends:** R = Remember U= Understand; A= Apply and above levels (BTL-Bloom's revised taxonomy Level)

**Course-PO Attainment Matrix**

| CO | Program Outcomes (PO) | | | | | | | Program Specific Outcomes (PSO) | |
|---|---|---|---|---|---|---|---|---|---|
| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PSO1 | PSO2 |
| CO1 | | | | | | | | | |
| CO2 | | | | | | | | | |
| CO3 | | | | | | | | | |
| CO4 | | | | | | | | | |
| CO5 | | | | | | | | | |
| TOTAL | | | | | | | | | |
| No. of COs Mapping with POs | | | | | | | | | |
| Average | | | | | | | | | |
| Round off(Average) | | | | | | | | | |
| Correlation | | | | | | | | | |
| Strong – S / 3 | | | Medium – M /2 | | | | Weak – W / 1 | | |

*Method is to relate the level of PO with the number of hours devoted to the COs which address the given PO.*

- If ≥40% of classroom sessions addressing a particular PO, it is considered that PO is addressed at Level 3
- If 25 to 40% of classroom sessions addressing a particular PO, it is considered that PO is addressed at Level 2
- If 5 to 25% of classroom sessions addressing a particular PO, it is considered that PO is addressed at Level 1
- If < 5% of classroom sessions addressing a particular PO, it is considered that PO is considered not-addressed.

## DETAILED SYLLABUS

Contents: Theory

| Unit | Name of the Topics | Hours |
|---|---|---|
| I | **Pulping mill**<br>**Chapter 1.1 -** Material Balance – Pulp mill<br>**Chapter 1.2 -** Digestor, Brown stock washer, Bleaching | 15 |
| II | **Secondary fibre Processing**<br>**Chapter 2.1 -** Deinking (Flotation cell) & Low consistency Pulper | 14 |
| III | **Stock Preparation**<br>**Chapter 3.1 -** Material Balance – Paper machine, Stock preparation<br>**Chapter 3.2 -** Headbox – Capacity, Fanpump, pipe size<br>**Chapter 3.3 -** Disc refiner, Centri – cleaner & Screening | 15 |
| IV | **Wet & Dry End**<br>**Chapter 4.1 -** Drying section, No of Dryers, Area of contact, Angle of wrap<br>**Chapter 4.2 -** Consistency of Pulp at various stages in Wire part and there effects.<br>**Chapter 4.3 -** Wire length &width, Dandy roll | 14 |
| V | **Production Calculation**<br>**Chapter 5.1 -** Production calculation for paper mill | 15 |

**Reference Books**


1 Hand book of pulp and paper technology Kenneth W. Britt CBS Publishers

2 pulp and paper volume I James P. Casey Academic Press

3 Pulping processes Sven A. Rydholm Inter science publisher

4 Pulp and paper Manufacture I and II Ronald G Macdonald McGraw Hill

5 Chemical recovery in alkaline pulping processes TAPPI monograph series No.32 TAPPI Publishers

## 5F6309 - Paper Technology Laboratory

Programme Name : DIPLOMA IN PAPER TECHNOLOGY

Course Code : 5F 6309

Term : VI

Course Name : Paper Technology Laboratory

### TEACHING AND SCHEME OF EXAMINATION

No of weeks per semester: 16 weeks

| Course | Instructions | | Examination | | | |
|---|---|---|---|---|---|---|
| | Hours / Week | Hours / Term | Marks | | | Duration |
| | | | Internal Assessment | Autonomous Examination | Total | |
| Paper Technology Laboratory | 4 | 64 | 25 | 100* | 100 | 3 Hrs. |

*** Examinations will be conducted for 100 marks and it will be reduced to 75 marks.**

**RATIONALE:**

Students will be given the idea of testing various grade of paper. The status of Indian industries in relation to paper testing should be imparted to them.

**OBJECTIVES:**

After the completion of this practical, the student should be able to know

- Various optical properties of paper
- Various strength Properties of paper
- Surface strength of paper
- Strength of various raw material

**Course Outcomes:**

| Course outcome | | BTL |
|---|---|---|
| **CO1** | Test basic properties of paper like Basis weight, thickness | **A** |
| **CO2** | Test strength properties of paper like Surface strength, Bursting & Tensile | **A** |
| **CO3** | Test physical properties of paper like smoothness, Softness & Porosity | **A** |
| **CO4** | Test optical properties of Brightness and Opacity of paper | **A** |
| **CO5** | Test bonding strength of paper | **A** |

**Mapping Course Outcomes (CO) - Program Outcomes (PO)**

| CO | Program Outcomes (PO) | | | | | | | Program Specific Outcomes (PSO) | |
|---|---|---|---|---|---|---|---|---|---|
| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PSO1 | PSO2 |
| CO1 | | | | | | | | | |
| CO2 | | | | | | | | | |
| CO3 | | | | | | | | | |
| CO4 | | | | | | | | | |
| CO5 | | | | | | | | | |
| TOTAL | | | | | | | | | |
| No. of COs Mapping with POs | | | | | | | | | |
| Average | | | | | | | | | |
| Round off(Average) | | | | | | | | | |
| Correlation | | | | | | | | | |
| Strong – S / 3 | | | Medium – M /2 | | | | Weak – W / 1 | | |

## DETAILED SYLLABUS

Contents: Practical

**Name of the Topics:**

**Exercise**

1. Basis weight, thickness, density and bulk
2. Bursting strength and burst factor
3. Tearing strength and tear factor
4. Tensile strength and breaking length
5. Brightness and Opacity of paper
6. Surface strength of paper(Wax pick)
7. Water absorbency – Cobb's method
8. Smoothness, softness and porosity
9. Degree of sizing
10. Determination of ply bond.

**Experiment Plan:**

| Module No. | Week No. | Experiments Name | Course Outcome | Weightage |
|---|---|---|---|---|
| | | Basis weight, thickness, density and bulk | | |
| | | Bursting strength and burst factor | | |
| | | Tearing strength and tear factor | | |
| | | Tensile strength and breaking length | | |
| | | Brightness and Opacity of paper | | |
| | | Surface strength of paper(Wax pick) | | |
| | | Water absorbency – Cobb's method | | |
| | | Smoothness, softness and porosity | | |
| | | Degree of sizing | | |
| | | Determination of ply bond. | | |

**Lab Assessment**

| Sl. No. | Rubrics (Sample) | Marks | | |
|---|---|---|---|---|
| | | **High 5-4** | **Medium 3-2** | **Low 1-0** |
| **Conduction of experiment (Software)** | | | | |
| 1. | Equipments & Sample Handling | Proper, Safest way of Chemical, Equipment Handling & Usage of PPE | Minimum usage of Proper , Safest way to Chemical, Equipment Handling & Usage of PPE | Safe less & Easiest way of Chemical, Equipment Handling without using PPE |
| 2. | Observation & Calculation | All the steps are followed correctly, sequence of Chemical addition & way of titration | Some steps are followed correctly, sequence of Chemical addition & way of titration | Steps are not followed correctly, sequence of Chemical addition & way of titration |
| 3. | Presentation of results | Accurate results & Calculation. Neatly presented | Complete and neatly presented, Minor mistakes in Result & Calculation | Incomplete results, Mistakes in Calculation Sequence |
| 4 | Viva | Almost all the questions are answered. | Partially answered | Unable to answer. |
| 5 | Promptness | The experiment is Completed on time. Observation/Record note is submitted on time | The experiment is completed on time but the Observation / Record note is not submitted on time. | The experiment is not completed on time. Observation / Record note is not submitted on time. |
| | Mark Allocation | 25-20 | 15-10 | 5-0 |

**LIST OF EQUIPMENTS**

- Quadrant scale, Thickness micrometer and Templates
- Bursting strength tester
- Elmendrof type Tearing strength tester
- Tensile strength tester Vertical load
- Brightness, Opacity and gloss tester
- Wax pick sticks
- Cobb's tester
- Smoothness and porosity tester Bendsten type
- Watch glass 6" and stop watch
- Ply bond tester

## 5F6310 - Chemical Recovery And Technical Analysis Laboratory

Programme Name : DIPLOMA IN PAPER TECHNOLOGY

Course Code : 5F 6310

Term : VI

Course Name : Chemical Recovery And Technical Analysis Laboratory

### TEACHING AND SCHEME OF EXAMINATION

No of weeks per semester: 16 weeks

| Course | Instructions | | Examination | | | |
|---|---|---|---|---|---|---|
| | Hours / Week | Hours / Term | Marks | | | Duration |
| | | | Internal Assessment | Autonomous Examination | Total | |
| Chemical Recovery And Technical Analysis Laboratory | 4 | 64 | 25 | 100* | 100 | 3 Hrs. |

*** Examinations will be conducted for 100 marks and it will be reduced to 75 marks.**

**RATIONALE:**

Students will be able to analyse are materials used for cooking of pulp and makeup chemical. He will be also able to analyse liquors generated during chemical recovery process including process water.

**OBJECTIVES:**

After completion of this practical, the student should be able to construct

- The cooking liquor composition (including AA, TA, TTA, EA, Sulphidity, Causticity and Concentration)
- New chemical analysis
- Process water analysis
- Effluent analysis

**Course Outcomes:**

| Course outcome | | BTL |
|---|---|---|
| **CO1** | Analyze salt cake, soda ash, Green liquor, White liquor | **R** |
| **CO2** | Determine the available calcium oxide in lime | **A** |
| **CO3** | Determine the amount of Total hardness Total solids, chlorides and total alkalinity in water | **A** |
| **CO4** | Analysis of smelt to determine reduction efficiency | **A** |
| **CO5** | Determine the purity of caustic soda | **U** |

**Mapping Course Outcomes (CO) - Program Outcomes (PO)**

| CO | Program Outcomes (PO) | | | | | | | Program Specific Outcomes (PSO) | |
|---|---|---|---|---|---|---|---|---|---|
| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PSO1 | PSO2 |
| CO1 | | | | | | | | | |
| CO2 | | | | | | | | | |
| CO3 | | | | | | | | | |
| CO4 | | | | | | | | | |
| CO5 | | | | | | | | | |
| TOTAL | | | | | | | | | |
| No. of COs Mapping with POs | | | | | | | | | |
| Average | | | | | | | | | |
| Round off(Average) | | | | | | | | | |
| Correlation | | | | | | | | | |
| Strong – S / 3 | | | Medium – M /2 | | | | Weak – W / 1 | | |

## DETAILED SYLLABUS

Contents: Practical

**Name of the Topics:**

**Exercise**

1. Determination of available calcium oxide in lime
2. Analysis of salt cake
3. Analysis of soda ash
4. Determination of purity of caustic soda
5. Analysis of Green liquor
6. Analysis of White liquor and determination of Causticising efficiency
7. Total hardness of water
8. Total solids, chlorides and total alkalinity of water
9. Analysis of smelt to determine reduction efficiency
10. $P^H$, Total Solids, Residual Active alkali determination in Black liquor

**Experiment Plan:**

| Module No. | Week No. | Experiments Name | Course Outcome | Weightage |
|---|---|---|---|---|
| 1 | 3 | Determination of available calcium oxide in lime | | |
| 2 | 4 | Analysis of salt cake | | |
| 3 | 5 | Analysis of soda ash | | |
| 4 | 6 | Determination of purity of caustic soda | | |
| 5 | 7 | Analysis of Green liquor | | |
| 6 | 8 | Analysis of White liquor and determination of Causticising efficiency | | |
| 7 | 9 | Total hardness of water | | |
| 8 | 10 | Total solids, chlorides and total alkalinity of water | | |
| 9 | 11 | Analysis of smelt to determine reduction efficiency | | |
| 10 | 12 | $P^H$, Total Solids, Residual Active alkali determination in Black liquor | | |

**Lab Assessment**

| Sl. No. | Rubrics (Sample) | Marks | | |
|---|---|---|---|---|
| | | **High 5-4** | **Medium 3-2** | **Low 1-0** |
| **Conduction of experiment** | | | | |
| 1. | Chemical Handling | Proper , Safest way of Chemical Handling & Usage of PPE | Minimum usage of Proper , Safest way to Chemical Handling & Usage of PPE | Safe less & Easiest way of Chemical Handling without using PPE |
| 2. | Accuracy of titration Results | All the steps are followed correct sequence of Chemical addition & The speed of titration | Some steps are followed correct sequence of Chemical addition & The speed of titration | Steps are not followed to sequence of Chemical addition & The speed of titration |
| 3. | Presentation of results | Accurate results & Calculation. Neatly presented | Complete and neatly presented, Minor mistakes in Result & Calculation | Incomplete results, Mistakes in Calculation Sequence |
| 4 | Viva | Almost all the questions are answered. | Partially answered | Unable to answer. |
| 5 | Promptness | The experiment is Completed on time. Observation/Record note is submitted on time | The experiment is completed on time but the Observation / Record note is not submitted on time. | The experiment is not completed on time. Observation / Record note is not submitted on time. |
| | Mark Allocation | 35 - 25 | 25 - 10 | 10 - 0 |

**LIST OF GLASS WARES AND EQUIPMENTS**

- Conical flasks 250 ml, 500 ml
- Pipettes 5 ml, 10 ml, 20 ml, 25 ml, 50 ml
- Burettes 50 ml
- Burette stand with clamp
- Funnels
- Watch glass 6” and 3”
- Wash bottles Plastic
- Hot plate and muffle furnace
- Tripod stand and wire gauze
- Silica crucible with lid
- Aspirator bottles
- Burners
- Beakers 250 ml, 500 ml
- Standard flask 250 ml, 1000 ml
- Silica dish 1000ml
- Air oven
- $P^H$ meter

## 5F6311 - Project Work

Programme Name : DIPLOMA IN PAPER TECHNOLOGY

Course Code : 5F 6311

Term : VI

Course Name : Project Work

### TEACHING AND SCHEME OF EXAMINATION

No of weeks per semester: 16 weeks

| Course | Instructions | | Examination | | | |
|---|---|---|---|---|---|---|
| | | | Marks | | | Duration |
| | Hours / Week | Hours / Term | Internal Assessment | Autonomous Examination | Total | |
| Project Work | 6 | 90 | 25 | 100* | 100 | 3 Hrs. |

*** Examinations will be conducted for 100 marks and it will be reduced to 75 marks.**

**RATIONALE:**

The student takes up a project (Either a case study or dissertation type) in consultation with staff members from SIT and paper mill personnel. He collects necessary literature and records data by conducting experiments whenever necessary and tabulates results and arrives at a conclusion.

**OBJECTIVES:**

- To develop the creative talents in the students.
- The project work should involve less cost, easy manufacturing technique and suitable to the real life situations.
- The project work should be useful to the mankind.
- To give the students a taste of real life problem solving and thus simulate industrial environment within the polytechnic.
- To develop those abilities that cannot be developed by normal class room situations such as group work, sharing responsibility, initiate, creativity etc.

**Course Outcomes:**

| Course outcome | | BTL |
|---|---|---|
| **CO1** | Applying the Theoretical knowledge studied in paper technology | **R** |
| **CO2** | Applying the Practical knowledge observed in Inplant training | **A** |
| **CO3** | Understanding the bottleneck situation in paper industry | **A** |

## Mapping Course Outcomes (CO) - Program Outcomes (PO)

| CO | Program Outcomes (PO) | | | | | | | Program Specific Outcomes (PSO) | |
|---|---|---|---|---|---|---|---|---|---|
| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PSO1 | PSO2 |
| CO1 | | | | | | | | | |
| CO2 | | | | | | | | | |
| CO3 | | | | | | | | | |
| CO4 | | | | | | | | | |
| CO5 | | | | | | | | | |
| TOTAL | | | | | | | | | |
| No. of COs Mapping with POs | | | | | | | | | |
| Average | | | | | | | | | |
| Round off(Average) | | | | | | | | | |
| Correlation | | | | | | | | | |
| Strong – S / 3 | | | Medium – M /2 | | | | Weak – W / 1 | | |

**Lab Assessment**

| Sl. No. | Rubrics (Sample) | Marks | | |
|---|---|---|---|---|
| | | **High 5-4** | **Medium 3-2** | **Low 1-0** |
| **Conduction of experiment (Software)** | | | | |
| 1. | Coding Skill | Show excellent understanding of the logic. The code is correct with regard to syntax. | Show minimal understanding of the logic. But the code has several syntax errors | Show no understanding of the logic and unable to write the code |
| 2. | Simulation steps / Debugging capacity | All the steps are followed correct sequence. Knows how to debug the error. . | Some steps are followed but error occurred. Debugged the error with the guidance. | Steps are not followed . Not showing interest to debug the error. |
| 3. | Presentation of results | Complete and accurate results, Neatly presented | Complete and neatly presented, Minor mistakes | Incomplete results, Major mistakes |
| 4 | Viva | Almost all the questions are answered. | Partially answered | Unable to answer.. |
| 5 | Promptness | The experiment is completed on time. Observation/Record note is submitted on time . | The experiment is completed on time but the Observation / Record note is not submitted on time. | The experiment is not completed on time. Observation / Record note is not submitted ontime. |
| | Mark Allocation | 25-20 | 15-10 | 5-0 |

## 5F6312 - Process Design & Simulation Practical

Programme Name : DIPLOMA IN PAPER TECHNOLOGY

Course Code : 5F 6312

Term : VI

Course Name : Process Design & Simulation Practical

### TEACHING AND SCHEME OF EXAMINATION

No of weeks per semester: 16 weeks

| Course | Instructions | | Examination | | | |
|---|---|---|---|---|---|---|
| | Hours / Week | Hours / Term | Marks | | | Duration |
| | | | Internal Assessment | Autonomous Examination | Total | |
| Process Design & Simulation Practical | 4 | 64 | 25 | 100* | 100 | 3 Hrs. |

*** Examinations will be conducted for 100 marks and it will be reduced to 75 marks.**

**RATIONALE:**

In Diploma level engineering education skill development plays a vital role. These can be achieved by experience in handling various equipments. This is accomplished by doing paper manufacturing related experiments in practical classes.

**OBJECTIVES:**

After completion of this practical, the student should be able to construct

- Able to handle various unit operation and plant at different condition of process variable using simulator.
- Need of simulator- Application of simulators distributed controlled system- Dynamic Graphic ( mimic),Bar graph- Trend and Alarm

**Course Outcomes:**

| Course outcome | | BTL |
|---|---|---|
| **CO1** | Analyze salt cake, soda ash, Green liquor, White liquor | **R** |
| **CO2** | Determine the available calcium oxide in lime | **A** |
| **CO3** | Determine the amount of Total hardness Total solids, chlorides and total alkalinity in water | **A** |
| **CO4** | Analysis of smelt to determine reduction efficiency | **A** |
| **CO5** | Determine the purity of caustic soda | **U** |

**Mapping Course Outcomes (CO) - Program Outcomes (PO)**

| CO | Program Outcomes (PO) | | | | | | | Program Specific Outcomes (PSO) | |
|---|---|---|---|---|---|---|---|---|---|
| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PSO1 | PSO2 |
| CO1 | | | | | | | | | |
| CO2 | | | | | | | | | |
| CO3 | | | | | | | | | |
| CO4 | | | | | | | | | |
| CO5 | | | | | | | | | |
| TOTAL | | | | | | | | | |
| No. of COs Mapping with POs | | | | | | | | | |
| Average | | | | | | | | | |
| Round off(Average) | | | | | | | | | |
| Correlation | | | | | | | | | |
| Strong – S / 3 | | | Medium – M /2 | | | | Weak – W / 1 | | |

## DETAILED SYLLABUS

Contents: Practical

**Name of the Topics:**

**Exercise**

1. Production calculation
2. Material Balance – Paper machine, Stock preparation
3. Material Balance – Pulp mill
4. Drying section, No of Dryers, Area of contact, Angle of wrap
5. Consistency of Pulp at various stages in Wire part and there effects.
6. Wire length &width, Dandy roll
7. Headbox – Capacity, Fanpump, pipe size
8. Disc refiner, Centri – cleaner & Screening
9. Deinking (Flotation cell) & Low consistency Pulper
10. Digestor, Brown stock washer, Bleaching

**Experiment Plan:**

| Module No. | Week No. | Experiments Name | Course Outcome | Weightage |
|---|---|---|---|---|
| 1 | 3 | Production calculation, | | |
| 2 | 4 | Material Balance – Paper machine, Stock preparation | | |
| 3 | 5 | Material Balance – Pulp mill | | |
| 4 | 6 | Drying section, No of Dryers, Area of contact, Angle of wrap | | |
| 5 | 7 | Consistency of Pulp at various stages in Wire part and there effects. | | |
| 6 | 8 | Wire length &width, Dandy roll | | |
| 7 | 9 | Headbox – Capacity, Fanpump, pipe size | | |
| 8 | 10 | Disc refiner, Centri – cleaner & Screening | | |
| 9 | 11 | Deinking (Flotation cell) & Low consistency Pulper | | |
| 10 | 12 | Digestor, Brown stock washer, Bleaching | | |

**Lab Assessment**

| Sl. No. | Rubrics (Sample) | Marks | | |
|---|---|---|---|---|
| | | **High 5-4** | **Medium 3-2** | **Low 1-0** |
| **Conduction of experiment** | | | | |
| 1. | Chemical Handling | Proper , Safest way of Chemical Handling & Usage of PPE | Minimum usage of Proper , Safest way to Chemical Handling & Usage of PPE | Safe less & Easiest way of Chemical Handling without using PPE |
| 2. | Accuracy of titration Results | All the steps are followed correct sequence of Chemical addition & The speed of titration | Some steps are followed correct sequence of Chemical addition & The speed of titration | Steps are not followed to sequence of Chemical addition & The speed of titration |
| 3. | Presentation of results | Accurate results & Calculation. Neatly presented | Complete and neatly presented, Minor mistakes in Result & Calculation | Incomplete results, Mistakes in Calculation Sequence |
| 4 | Viva | Almost all the questions are answered. | Partially answered | Unable to answer. |
| 5 | Promptness | The experiment is Completed on time. Observation/Record note is submitted on time | The experiment is completed on time but the Observation / Record note is not submitted on time. | The experiment is not completed on time. Observation / Record note is not submitted on time. |
| | Mark Allocation | 35 - 25 | 25 - 10 | 10 - 0 |

## 5F7312 - Control Laboratory Utilities & Instrumentation

Programme Name : DIPLOMA IN PAPER TECHNOLOGY

Course Code : 5F7312

Term : VII

Course Name : Control Laboratory Utilities & Instrumentation

### TEACHING AND SCHEME OF EXAMINATION

No of weeks per semester: 16 weeks

| Course | Instructions | | Examination | | | |
|---|---|---|---|---|---|---|
| | Hours / Week | Hours / Term | Marks | | | Duration |
| | | | Internal Assessment | Autonomous Examination | Total | |
| Control Laboratory Utilities & Instrumentation | 24 | 576 | 25 | 100* | 100 | 3 Hrs. |

*** Examinations will be conducted for 100 marks and it will be reduced to 75 marks.**

**RATIONALE**

Most of pulp and paper mill operations will involve mechanical and electrical operation. Therefore it is extremely necessary to have good understanding about the unit process as well as unit operation. These methods can be used for understanding the performance of the papermaking unit using process instrumentation & control equipment. With the help of control laboratory to maintain the quality as well as quantity of product

**OBJECTIVES**

At the end of this course, students will be able to

- Understand how the physical parameters of the processes (Temperature, Pressure, Liquid level, Flow rate etc. are measured & controlled in paper industries and they would acquire hands on experience of measurement and control of chemical process parameters. After completion of this laboratory, they will be aware of computer control of process variables and the probable causes and effect of instrument failure.
- Water and energy consumption in paper mill

  As soon as the inplant training is over the students will able to know
  - Various control over process
  - Knowledge about various boilers
  - Knowledge about automatic control valves, Distributed control system operations etc.

**Course Outcomes:**

| Course outcome | | BTL |
|---|---|---|
| **CO1** | Understand the physical parameters & equipments used in Laboratory | **R** |
| **CO2** | Aware of computer control of process variables and the probable causes and effect of instrument failure | **A** |
| **CO3** | Know about the Water and energy consumption in paper mill | **A** |
| **CO4** | Knowledge about automatic control valves, Distributed control system operations | **A** |
| **CO5** | Understand the physical parameters & equipments used in Labaratory | **U** |

**Mapping Course Outcomes (CO) - Program Outcomes (PO)**

| CO | Program Outcomes (PO) | | | | | | | Program Specific Outcomes (PSO) | |
|---|---|---|---|---|---|---|---|---|---|
| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PSO1 | PSO2 |
| CO1 | | | | | | | | | |
| CO2 | | | | | | | | | |
| CO3 | | | | | | | | | |
| CO4 | | | | | | | | | |
| CO5 | | | | | | | | | |
| TOTAL | | | | | | | | | |
| No. of COs Mapping with POs | | | | | | | | | |
| Average | | | | | | | | | |
| Round off(Average) | | | | | | | | | |
| Correlation | | | | | | | | | |
| Strong – S / 3 | | | Medium – M /2 | | | | Weak – W / 1 | | |

## 5F 7313- Paper Making Operation & Mechanical Maintenance

Programme Name : DIPLOMA IN PAPER TECHNOLOGY

Course Code : 5F 7313

Term : VII

Course Name : Paper Making Operation & Mechanical Maintenance

### TEACHING AND SCHEME OF EXAMINATION

No of weeks per semester: 16 weeks

| Course | Instructions | | Examination | | | |
|---|---|---|---|---|---|---|
| | Hours / Week | Hours / Term | Marks | | | Duration |
| | | | Internal Assessment | Autonomous Examination | Total | |
| Paper Making Operation & Mechanical Maintenance | 24 | 576 | 25 | 100* | 100 | 3 Hrs. |

*** Examinations will be conducted for 100 marks and it will be reduced to 75 marks.**

**RATIONALE**

After in plant training the students known's about how the paper is made from raw material. They have through knowledge of papermaking sheet forming, pressing, drying and calendaring etc.

**OBJECTIVE**

At the end of this course, students will be able to

- Know the process of the paper machine
- Know the procedure to operate equipment and handling techniques
- Know the operating procedure including the start-up and shut down procedure
- Know the variables affecting efficiencies, production rate
- Know the unit operations and their electrical and mechanical maintenance
- Know the paper making common problems and trouble shooting, operational parameters and controls, quality control on paper machine

At the end of the in plant training

- Hands on experience in paper making machine
- Knowledge about good run ability of paper machine
- Knowledge about required moisture at various places
- Idea about paper production & troubleshooting knowledge

**Course Outcomes:**

| Course outcome | | BTL |
|---|---|---|
| **CO1** | Know the procedure to operate equipment and handling techniques & process of the paper machine | **R** |
| **CO2** | Know the variables affecting efficiencies, production rate | **R** |
| **CO3** | Understand the common problems and trouble shooting, operational | **U** |
| **CO4** | Understand the Parameters and controls, quality control on paper machine | **U** |
| **CO5** | Have hands on experience in paper making machine | **A** |

## Mapping Course Outcomes (CO) - Program Outcomes (PO)

| CO | Program Outcomes (PO) | | | | | | | Program Specific Outcomes (PSO) | |
|---|---|---|---|---|---|---|---|---|---|
| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PSO1 | PSO2 |
| CO1 | | | | | | | | | |
| CO2 | | | | | | | | | |
| CO3 | | | | | | | | | |
| CO4 | | | | | | | | | |
| CO5 | | | | | | | | | |
| TOTAL | | | | | | | | | |
| No. of COs Mapping with POs | | | | | | | | | |
| Average | | | | | | | | | |
| Round off(Average) | | | | | | | | | |
| Correlation | | | | | | | | | |
| Strong – S / 3 | | | Medium – M /2 | | | | Weak – W / 1 | | |