

# **FOREST RESEARCH INSTITUTE DEEMED TO BE UNIVERSITY DEHRADUN**

*M. Sc.  
Cellulose & Paper Technology*



## **BROCHURE-2019**



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## **From the Vice Chancellor's Desk**

The Forest Research Institute (FRI), founded in 1906, is a premier institute in the field of forestry research and education. FRI, one of the institutes of the ICFRE, Dehradun, was conferred the status of University in the year 1991 on the recommendation of the UGC, Ministry of HRD, Government of India.

The M.Sc. Cellulose and Paper Technology course started in 2011 is designed to train students as future technocrats and provides an upto date knowledge on Pulp and Paper Technology practices all over the world. New and relevant courses like State of the Art pulping and bleaching processes, Chemical Recycle and Energy Generation, waste Management Technology form Mill Effluents, Modern Chemical Engineering in Paper Industries, Marketing Systems and Project Formulation have been added to supplement the already existing syllabus that includes traditional streams of forestry such as Stock Preparation, Pulping and Bleaching. Equal emphasis is maintained on course work and industrial exposure during the entire course.

The faculty of the course includes eminent scientists and technical officers having a long experience of teaching and research. The course is well equipped to handle the ever dynamic field of paper technology and also exposes the students to Paper Mill Operations, Paper testing procedure and process designs.

On behalf of the institute, I invite Corporates, NGOs, and other employers to assess the caliber of our budding technocrats. They are an integral part of the century-old tradition of paper science in India. I wish the students of M. Sc. Cellulose and paper technology the very best in their careers.

Vice Chancellor  
FRI Deemed to be University



## **From the Dean's desk**

Dear colleagues, entrepreneurs and recruiters,

The Forest Research Institute (Deemed to be) University (FRIDU), is one of the premier Institutes of Forestry and allied fields working under Indian Council of Forestry Research & Education (an autonomous Council of Govt. of India, Ministry of Environment, Forest & Climate Change). The Government of India, Ministry of Human Resource Development declared Forest Research Institute as Deemed to be University in the year 1991. FRI aims for academic excellence in the field of forestry, environment, wood science and paper technology and to achieve this, renowned experts conduct teaching and practical sessions, which introduce students to the most current developments, thinking and practices in a variety of academic and professional fields. In this context I shall take the pleasure to introduce you to M.Sc. Cellulose & Paper Technology course. The 2 years' course is jointly conducted by FRIDU and Central Pulp & Paper Research Institute, Saharanpur. The course is well acclaimed as an industry driven speciality course of paper science where every year we enroll students from all over India and SAARC nations through a stringent National Level Entrance. The courses equip students to fulfil the present industrial needs maintaining highest professional and scientific standards for various sectors of paper and allied industries. The students are provided with an excellent natural environment with a great campus, diverse culture, active co-curriculums and direct exposure to the advanced industrial practices and technologies of the field. The students are also allowed to handle and manage official issues and events so as to make them capable enough to carve out their niche in any kind of situation. They are well trained to lead projects in lab, industry or fields, analyse, and as well, perform successfully in policy formulations. Our aim is that the students emerge from the institute to become pragmatic professionals, responsible citizens and successful leaders. Our students are triumphantly carrying our flag in different Governmental bodies, renowned Industries and International Agencies. It is a pleasure to invite you to our campus placement to experience our student resources and we look forward for a mutually beneficial, and a long-term relationship.

Dr. H.S. Ginwal Dean (Academics)  
FRI (Deemed to be) University, Dehradun.

## About the University

Forest Research Institute (FRI), Dehradun has its roots in the erstwhile Imperial Forest Research Institute (IFRI) started in 1906. The Institute was established to organize and lead forestry research activities in South Asia. The Institute also administered training to forest officers and forest rangers in the country. After Independence, IFRI was aptly renamed as Forest Research Institute and Colleges. To fulfill premier needs of forestry and environment professionals in the country, the premier Forest Research Institute was conferred the status of Deemed University in 1991 by University Grants Commission (Under section 3 of UGC Act 1956 vide notification no.-F.9-25/89-U3 dated 6-12-1991). Since 2006, it is known as Forest Research Institute Deemed to be University.

## OBJECTIVES

- To impart education in different branches of forestry and environment.
- To provide facilities for research and development and dissemination of knowledge in the field of forestry and environment.
- To create consciousness about forest and environment among people through forestry extension programmes.
- To carry out such other activities as may be necessary and desirable for further safeguarding of environment and protection of forests and wildlife.

## COURSES

### **M.Sc. Cellulose & Paper Technology**

This course is proposed for students who are graduates in Science with Chemistry as one of the subjects or BE/B.Tech (Chemical or Mechanical Engineering).

### **M.Sc. Forestry**

The academic requirement for this course is B.Sc. with at least one of the subjects from Botany, Chemistry, Geology, Mathematics, Physics and Zoology or B.Sc. in Agriculture or Forestry.

### **M.Sc. Wood Science & Technology**

The academic requirement for this course is B.Sc. with Physics, Chemistry and Mathematics or B.Sc. in Forestry.

### **M.Sc. Environment Management**

The academic requirement for this course is B.Sc. in any branch of basic or applied Sciences or Bachelor's degree in Forestry or Agriculture or BE in Environment Sciences.





### **SAARC FELLOWSHIP**

Ten fellowships per year are being provided to the students from SARRC countries from the year 2012.

### **SCHOLARSHIP**

FRI University provides merit scholarship to the topper students in each course. For the purpose of award of scholarship in the first semester the result of the entrance test is considered and the topper in general and SC/ST category are awarded the scholarships in each course.

### **CULTURAL ACTIVITIES**

Students from different parts of the country having different cultural backgrounds join the University and the Student club gives them opportunity to present their rich cultural heritage during the annual cultural program.

### **HOSTEL**

Separate hostels for boys and girls are available within the campus. The hostels have well equipped gym alongwith indoor and outdoor games facilities. Round the clock Internet facility is available.

### **SPORTS AND GAMES**

Every year annual sports are organized by the University during which the students show their talent and the outstanding students get opportunity to participate in annual All India Forest Sports Meet.

### **MEDICAL FACILITIES**

The FRI has its own well equipped 30 bedded hospital with qualified doctors and para-medical staff. Round the clock medical facilities with ambulance services are available.

### **TOURS AND VISITS**

Students of all courses visit different parts of the country to get practical exposure of different sites related to the wood science, paper technology, forestry and environment as a part of their curriculum. The students are also attached with reputed Industries/Institutions to complete dissertation for four to six months duration to familiarize them with the practical difficulties and latest technologies of the industries.

### **WORKSHOP/SEMINARS**

To acquaint the students with the latest technologies in Forestry they are encouraged to participate in various workshops/seminars organized by different Divisions of FRI in their National and International funded projects.

### **DOCTORAL PROGRAM**

A student can pursue research and studies leading to an award of Ph.D. degree at FRI (Deemed) University or any of ICFRE research centre established all over the country. The research facilities in the field of forestry and allied subjects at the FRI (Deemed) University are amongst the best in the country.

# FOREST RESEARCH INSTITUTE

## HISTORY

The progress of forestry research in India is interwoven with the early management of forests after 1864, when the Indian forest department was established. During the initial stages forest management practices were gradually strengthened by scientific curiosity of early foresters in laying out trials for develop appropriate techniques of forestry practices. Central Forest School was founded in 1878 for training of rangers at Dehradun. In 1884 the Govt. of India took over the management of this school from the Govt. of North-West Provinces and renamed it as Imperial Forest School and placed it under the supervision of the Inspector General of Forests. Forestry research started from an incipient chemistry laboratory. In 1906, Imperial Forest Research Institute (IFRI) was created at Dehradun, later on named as Forest Research Institute and Colleges (FRI&C), to become the premier institution of forestry research in the country. The grandiose FRI building with office and laboratory space of about 5,800 sq. m. and six museums covering 2,400 sq. m., was built with a cost of Rs. 56 lakhs over a plinth area of 7 acres and was inaugurated in 1929 by Lord Irwin.



## STUDY AREAS

The FRI provides multidisciplinary platform to its Students in various study areas like :

### 1. BOTANY

Botany Division is one of the six disciplines established in 1906 in the erstwhile Imperial Forest Research Institute. The division is aimed at carrying out forestry research activities in the subject of Forest Botany under its five disciplines namely; Systematic Botany, Plant Physiology, Wood Anatomy, Bioprospecting & Biopiracy and Tissue Culture.

### 2. CHEMISTRY & BIO PROSPECTING

Chemistry Division has a very long record of carrying out research in Chemistry of Forest Products towards utilization and promotion of wood and non wood forest products important for development of essential oils, medicinal products ,nutraceuticals, fatty oils, tannins, dyes, biopesticides, gums; resins, starches, waxes, cellulose, etc.; having a laboratory equipped with modern instrumentation facilities.

### 3. FOREST ECOLOGY AND ENVIRONMENT

Ecology & Environment division came into existence in 1948 under the directorate of Silviculture Research. The division applies multidimensional research on structure and functioning of forest ecosystem, wetland ecosystem, ecosystem services, biodiversity conservation, rehabilitation and management of disturbed lands and pollution abatement through vegetation.

### 4. FOREST ENTOMOLOGY

Forest Entomology Division is one of the six founder branches of FRI, established in 1906. The division has a world renowned National Forest Insect collection having its unique insect collection mainly of Forestry importance. It has about 18,000 authentically identified forest insects' species which include 1,800 type specimens. Collection has more than 3,00,000 pinned specimens of forest insects and world class Museum which depicts approximately 3,000 of wood samples degraded or damaged by wood boring / wood feeding insects.

### 5. FOREST PATHOLOGY

The work on forest pathology initially started in Forest Mycology Section under Botany Branch in 1927 and later was elevated to a full-fledged branch in 1950. The Branch was renamed as Forest Pathology Branch in 1957. The Division has collection of nearly 12000 specimens of diseases and pathogens in its Museum and Herbarium and also a culture collection of about 1000 live fungi at National Type Culture Collection. The Division also provides identification services for diseases, fungi, decay in wood samples.

### 6. FOREST PRODUCTS

Forest Products Division is one of the oldest establishments in the Institute & the repository of basic and

applied data on 'Wood Science and Technology in India. The Department covers all aspects of the research and testing of wood-based materials from raw materials to final products. Our research intensively focuses on R & D aspects of Timber Mechanics, Composite Wood, Wood Seasoning, Wood Preservation, Timber Engineering, Wood Working & Finishing estimating the feasibility of wood-based materials for different end uses.

#### **7. FOREST SOIL & LAND RECLAMATION**

Scientific investigations on Forest Soil were initiated in the early forties through the formation of Soil Section which was upgraded to Forest Soils Branch. The branch is devoted to the research on soil physical, chemical and mineralogical investigations.

#### **8. GENETICS AND TREE PROPAGATION**

The Division of Genetics and Tree Propagation was established in 1959. The division carries out research on the genetic improvement of different forest tree species including medicinal plants through concepts of genetics, tree breeding and biotechnology. Modern facilities are available for advanced genetics and molecular marker research with molecular biology laboratories and vegetative propagation complex.

#### **9. NON WOOD FOREST PRODUCTS**

The Non-Wood Forest Products Division is one of the oldest division. In 1906 economic research on minor forest product was entrusted to the economic branch under the leadership Mr. R.S. Troup. Quality work has been conducted on major NWFPs of socio economic importance like leaves, bamboo, canes, gums, resin, oils, fibre, flosses, tannins, dyes and most importantly medicinal plant wealth.

#### **10. RESOURCE SURVEY AND MANAGEMENT**

A forest Economic Branch was created at the erstwhile Imperial Forest Research Institute at Dehradun as early as in 1906. This branch included the research on Forest Mensuration and Management & is continuing its work today under the division of the Resource Survey & Management.

#### **11. SILVICULTURE**

Silviculture Division was one of the six research disciplines to have been started at the initiation of forestry research at the institute. Nursery and planting techniques of 550 important commercial species of trees, shrubs and bamboos have been developed. Museum, seed laboratory, Clonal Seed Orchard, Vegetative Multiplication Garden, plantation trials, central nursery and divisional nurseries are being maintained by the division.

#### **12. BIO-INFORMATICS AND GIS**

The Forest informatics & GIS Division consists of IT Cell, Geomatics Cell and Bio-informatics Centre, was created in 2008 to cater the latest needs of students & Research scholars also. The division also gives its services to various State Govt.

#### **13. CLIMATE CHANGE AND FOREST INFLUENCES**

The division is established to study the Climate Change and Forest Influences of our environment including the topics i.e. Carbon sequestration, Vegetation shifts, EIA, REDD<sup>+</sup>, etc.



#### **14. EXTENTION**

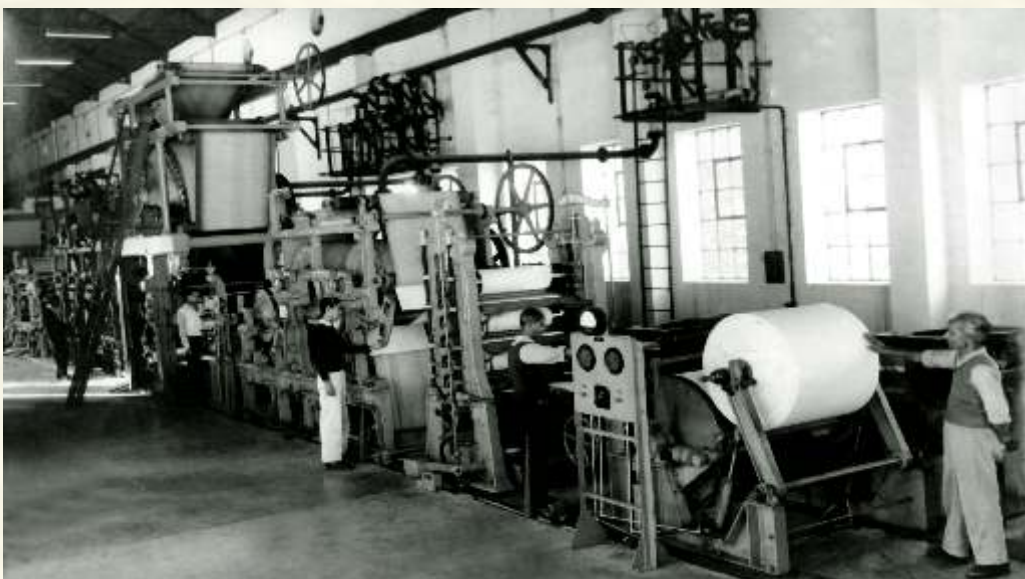
The aim of the division is to organize and facilitate the trainings for smooth and effective dissemination of different technologies to target groups including farmers SHGs,NGOs and SFDs etc. The division was created for lab to transfer.

#### **15. NATIONAL FOREST LIBRARY & INFORMATION CENTER**

Richest document collection on forestry & environment in Asia. More than 1,65,000 books,7000 ledger entries with research articles and foreign and Indian Journal subscription.

#### **16. CELLULOSE & PAPER**

Cellulose and Paper Division, Forest Research Institute (FRI), Dehra Dun has an impressive record in conducting research and development in the field of pulp & paper technology since 1906 when Sir William Raitt, the paper technologist, initiated studies on evolving efficient and economic process for preparation of easy bleaching pulp from bamboo. In 1960 due to the shortage of bamboo, extensive research work was carried out on suitability of tropical hard woods for paper making. With the outcome of research work at Cellulose & Paper Division, lot of Indian paper mills started using hard woods as a raw material for paper making. The research and development activities were intensified and a versatile pilot plant of 6.0tpd capacity with a combination of improved cylinder mould and fourdrinier paper machines was commissioned. Since then the division has worked for the production of high yield pulping process, improving of high yield pulps, bio-degradation of lignin, beater, development of specialty paper, Bioethanol production from ligno cellulose & wetend additives for recycled paper.



## **Achievements of the Division:**

### **(a) Pilot Plant Trials**

Different types of raw materials like hard woods, soft woods, bamboos, agricultural residues and grasses were evaluated for paper making at pilot scale.

### **(b) Development of specialty paper**

Various kinds of specialty papers like mica paper, Braille paper, High-grade tissue paper, Absolute filter paper, Medium filter paper, Electrical grade paper, Pyroline cellulose sheets for use in defense were prepared for different government organizations.

### **(c) Technologies**

No. of processes such as manufacture of mica paper mica for use as electrical insulator, cold soda process for recovery of chemicals from soda black liquor, process for the reinforced of brittle and fragile ancient documents including machine ,process for improving high yield pulps through chemical modification, process for producing synthetic lignosulphonates from soda and kraft pulping spent liquors lignin were patented.

### **(d) Research Papers**

As a result of work done over 600 research papers have been published in different national and international scientific journals on various aspects of pulp and paper science and technology.

### **(e) Ph.D.**

About 110 students awarded PhD degree on the research works conducted at the division.

### **Some landmark Research works:**

- Development of high yield pulping process to conserve raw materials and improve high yield pulps for increasing their use in various grade papers.
- Development of new and / or modified pulping process and optimization of process control parameters & Characterization and utilization of blackliquor.
- Development of biotechnology processes for pulp & paper production. Characterization of enzymes, standardization of enzymatic pre-bleaching of pulp, enzymatic refining of pulp and bio-pulping of indigenous wood.
- Development of technology for effluent treatment: standardization of biological treatment of effluent in reducing organic load and toxic effects.
- Bioconversion of lignocellulosic forest waste biomass for ethanol production.
- Modifications of alpha cellulose for various industrial applications.



- Sponsored research projects pertaining to pulp, paper and board manufacture and related field.
- Evaluation of new raw materials including plantation – grown species of hardwoods for pulps, paper and board industry & recycling of waste paper to augment raw material shortage.
- Utilization of non-wood fibers and various grades of waste paper.
- Effect of improved operational parameters on hydrolysis of lignocellulosic biomass to enhance total reducing sugar yield for bioethanol production.
- Biodeinking of waste paper & manufacturing of handmade paper
- Chemoenzymatic saccharification of cellulosic biomass



The Indian pulp and paper industries have acute shortage of trained manpower. Forest Research Institute is engaged in imparting training in pulp and paper technology since 1959. Large numbers of trained personnel from FRI are occupying the apex position in pulp and paper industry. The activities in respect of training in pulp and paper technology are as follows:

1. M.Sc. Cellulose and Paper Technology.
2. Research leading to award of Ph.D.

The MSc course is jointly conducted by FRI University Dehradun and Central Pulp & Paper Research Institute Sharanpur. The students study basics of Paper Technology in First year at FRI Dehradun and then they join CPPRI Sharanpur for getting technical and industrial exposure for second year.

## Syllabus

**Programme Objectives:** The academic programme emphasizes on skills in multidisciplinary and advance education in cellulose and paper sciences. Programme includes courses in modern areas of applied paper science, industrial processing and paper technology. During the university's educational programme at Masters level, the students receive adequate exposure of theoretical and practical aspects of cellulose and paper technology and gain competence in a distinctive set of skills to lead in paper industry. The course is also ideal for engineers and scientists currently working in the industry who wish to retrain and refresh in a new field.

**Programme Structure:** The programme consists of courses and other requirements worth a total of 91 credits. One credit is equivalent to one hour of teaching (lecture or tutorial) or two hours of practical work/field work per week. Each semester will consist of 18-20 weeks of academic work equivalent to 90 teaching days. The programme structure and respective credits are given below as:

Programme Structure	Credits
Core courses	: 77
Foundation courses	: 3
Project work	: 8
In Plant training	: 3
<b>Total</b>	<b>: 91</b>

## Credits Breakup

First Year at FRI Deemed to be University

### FIRST SEMESTER

S. No.	Course Code	Course	Credit
<b>Foundation course</b>			
1.	PP-111	Basic Forestry	3
<b>Core Course</b>			
2.	PP-112	Paper Industry & Fibrous Raw Materials	4
3.	PP-113	Pulping	4
4.	PP-114	Elements of Mechanical & Electrical Engineering	4
5.	PP-115	Washing of pulp	3
6.	PP-116	Practical	5
<b>Total credits in first semester :23</b>			



### SECOND SEMESTER

S. No	Course code	Course	Credit
<b>Core Course</b>			
1.	PP-121	Refining, Beating & Chemical Additives	4
2.	PP-122	Paper Machines-I	4
3.	PP-123	Paper Machines-II	3
4.	PP-124	Papermaking Chemistry	3
5.	PP-125	Screening and Cleaning	3
6.	PP-126	Practical	5
<b>Total Credits in second semester: 22</b>			



### THIRD SEMESTER

S. No	Course code	Course	Credit
<b>Core course</b>			
1.	PP-211	Chemical Recovery	4
2.	PP-212	Bleaching Technology	4
3.	PP-213	Material and Energy Balance	4
4.	PP-214	Paper Properties	3
5.	PP-215	Secondary Fibre Technology	4
6.	PP-216	Practical	5
<b>Total Credits in third semester: 24</b>			



### FORTH SEMESTER

S. No	Course code	Course	Credit
<b>Core course</b>			
1.	PP-221	Specialty Paper	3
2.	PP-222	Environmental Pollution Control	3
3.	PP-223	Project Work	8
4.	PP-224	In Plant Training	3
5.	PP-225	Practical	5
<b>Total Credits in fourth semester: 22</b>			



# Glimpses of various Course from programme

## BASIC FORESTRY

The role of basic forestry course is to provide the fundamental knowledge of forestry science, silviculture and processing of wood and non wood materials for pulp and paper industry. The specific emphasis is focused on those species which are widely employed by pulp and paper industries for generation of pulp and paper products. The content of the course gives an in-depth coverage to all the basic forestry science involved in overall handling of raw material. In addition to this, it describes the main features of forests and forestry, including the production of timber and biomass and its delivery to the industry particularly pulp and paper, in the context of sustainability.

## PAPER INDUSTRY AND FIBROUS RAW MATERIALS

The course imparts knowledge on the status and structure of Indian and global paper industry scenario. The content of the course seek out to train students in the theoretical and practical aspects of raw material morphology and physico-chemical characteristics of fibrous raw material used in paper manufacturing preferably softwoods, hardwood, non-wood including agro residues viz. bamboo, reeds, bagasse, wheat straw, rice straw, sarkanda, cotton and other alternative lignocellulosic fibers. It gives a well sound overview of the structure and chemical composition of lignocellulosic biomass followed by a description of the basic chemical processes taking place during delignification.

## PULPING

The principal objective of this course is to provide detailed knowledge and skills in the pulping technology. The content of the course gives an in-depth coverage in the practical aspects of mechanical, chemical, semi chemical and chemi-mechanical pulping by practical problem-solving exercises in the context of pulping operations. The course deals with preparation of white liquor and its analysis, H-factor assessment, evaluation of pulp quality with respect to viscosity, drainability, Kappa no., continuous and batch mode pulping operations, blow heat recovery system, extended and oxygen delignification processes. It covers all the basics and fundamentals of pulping technology including recent modern advancements.

## ELEMENTS OF MECHANICAL AND ELECTRICAL ENGINEERING

This course fulfills the requirement of basic and the fundamentals mechanical and electrical engineering as expected from a technically sound personal working in pulp and paper industry. The course is designed to develop competence in machine models and their workings used in pulp and paper industry. The content of the course gives an in depth knowledge in respect to steam, steam boilers, furnace, draft, fuel and combustion, steam turbine, steam to power cycles, cooling device, boiler feed water treatment. Moreover, it profoundly helps to understand mills operations and techniques including fluid mechanics and electrical circuits. The analytical aspects of enthalpy, calorific value, capacity and efficiency of boilers, heat transfer, radiation, conduction and convection, heat exchange, rate of heat transfer, thermal insulation, steam and power requirement in pulp & paper industry, co-generation, co-generation economics are thoroughly explored.

## WASHING OF PULP

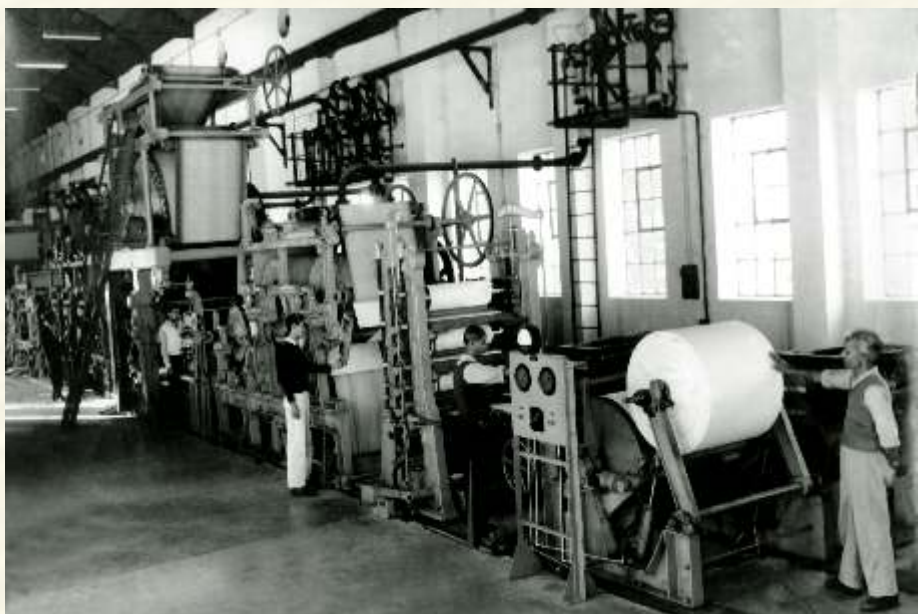
The course provides sound knowledge of pulp washing process. It covers the working phenomenon of washing equipments, operational principles, types of washing in paper industry, fundamental principles and factors



affecting washing for the proper management and planning of water resources. Moreover, it covers the various analytical aspects of washing like displacement ratio, washing efficiency, dilution factor, washing losses.

### **REFINING, BEATING & CHEMICAL ADDITIVES**

The course imparts knowledge for basic composition, applications, handling and reaction mechanism of different additives used in paper industry. It gives a thorough understanding in view of wet and dry strength additives, mechanistic approach of strength development, filler addition, introduction of dyes their types and working phenomenon, retention and drainage on paper machine, basic surface science considerations in sizing, types of sizing agents, AKD, ASA, rosin and trouble shooting of sizing problems. In addition to this, this course imparts significant knowledge on core basic fundamentals of beating and refining aspects along with broad understanding of design and construction of stock preparation equipments including beaters, conical and disc-refiner, stock chest and agitators.



### **PAPER MACHINES-I**

The course provides detailed knowledge and skills in the papermaking process, machines with a focusing on key engineering and technical aspects involved. This imparts an in depth understanding of the basic principles of approach flow system, headbox, four drainer and paper former. Furthermore, it covers webs transfer and cylinder mold formation, stock and white water system and advances in paper former, function, design and types of headbox, components of a four drainer table and their function, sheet formation theories, suction boxes function and vacuum control, couch roll function, dandy-functions.

### **PAPER MACHINES-II**

To course provides an in depth knowledge and skills in paper machines with a specific focusing on wet pressing, sizing and calendaring. The course content deals with the detailed understanding of pressing mechanism, drying principles and Yankee dryers, drying methods, calendaring and super calendaring, operating variables for calendar stack, paper machine clothing, re-winder and sheeters.

### **PAPERMAKING CHEMISTRY**

The course imparts knowledge in view of chemistry involved in papermaking. It gives a complete coverage to fiber-fiber water bonding phenomenon, ion-exchange and electro-kinetic phenomenon of cellulose, effect of processing operations such as pulping, bleaching and refining on electrokinetic properties on cellulose and chemistry involved in coagulation, flocculation, retention, foam and slime control in papermaking.

### **SCREENING AND CLEANING**

The screening and cleaning course gives detailed understating of pulp processing and provides a broad understanding for screening, cleaning and thickening mechanisms and its importance. In brief, it gives a complete coverage to screening objectives, types of screens, design of cleaners and modifications, objectives of thickening and thickening equipments with their mode of applications.

## CHEMICAL RECOVERY

The course imparts thorough understanding of the chemical recovery process, black liquor characteristic, desilication and concentration. The content of the course covers all the basic fundamentals including assessment of thermal and rheological properties of black liquor; study of TDS, TSS, RAA, TA, organically bound sodium, elemental analysis, colloidal stability at high concentrations, foaming characterization, calorific value, SVR, thermal conductivity, specific heat, IPDT, TIG, polymeric properties. In addition to this, the course imparts sound knowledge of different evaporator systems and their designing, causticization and Lime Kiln, scale formation and trouble-shooting on scale formation.



## BLEACHING TECHNOLOGY

The course provides an understanding of the importance, mechanisms and processes of bleaching technology used for various classes of pulp. The course content imparts knowledge that deal with objectives of bleaching, bleach-ability and its measurement, single stage and multistage bleaching processes, bleaching of chemical, mechanical and semi- chemical pulps, preparation of different bleach liquors, instrumentation and process control in bleach plants, operating variables of different bleaching stages and advances in bleaching technologies including bio-bleaching.

## MATERIAL AND ENERGY BALANCE

The material and energy balance course provide an understanding of material balance, vapour-liquid equilibrium, psychrometric and fuels related to pulp and paper industry. The course content imparts thorough knowledge of mass laws, vapour pressure plots, multicomponent gas liquid equilibrium, steam tables and their use, mechanical energy balance with chemical reaction, GHV, NCV, proximate and ultimate analysis.

## SPECIALITY PAPER

The course imparts knowledge in the manufacturing and applications of speciality papers. The content of the course gives an in depth coverage for the study of different types of coating pigments used viz. Kaolin, GCC, PCC, talc, TiO<sub>2</sub>, aluminum trihydrates, synthetic plastic pigments, characteristics and application of dispersants, viscosity modifiers, coating binders, coating techniques and processes, characteristics of various grades such as newsprint, SC papers, coated mechanical papers, uncoated fine papers, coated fine papers, special fine papers, electrical papers, absorbent papers, filter papers, special strong papers, copy and imaging papers, wrapping and packaging papers, cigarette papers and other functional papers.

## SECONDARY FIBER TECHNOLOGY

The course imparts an in depth knowledge with respect to evaluation of secondary fibers for paper manufacturing including equipment knowledge and processing techniques. The course deals with different pulping processes, deinking process, washing, cleaning and screening of pulp mass, quality assessment of deinked pulp, screening system design, bleaching of secondary fiber, water and waste water treatment in recycling mills and environmental impact of paper recycling. The content of the course covers all the fundamental aspects of secondary fibre processing essentially required for paper making.

## PAPER PROPERTIES

This covers all the practical aspects of paper properties and their



applications for different grades. The course imparts fundamental knowledge of various physical, mechanical, resistance, barrier and optical properties of paper. In addition to this, understanding of the basic principles of statistical tools used in paper testing and environmental effect on paper properties are also covered within the course. A regular hands on training with analytical instruments for assessment of paper properties makes the practical aspects more and more sound.

## ENVIRONMENTAL POLLUTION CONTROL

The course imparts detailed knowledge and skills in the management, treatment, disposal and recycling options for solid wastes. It further deals with basic understanding of legal acts related to environment and hazardous management. The content of the course gives an in depth coverage to solid waste generation and management, pollution control standards norms, effluent treatment methods, zero-effluent concept, bioremediation of effluents, biomass adopting bio-refinery approach in pulp and paper industry and different acts related to environmental protection.

## FIELD EXPOSURE

The students are taken for industrial visits in various paper mills and industries as part of the course curriculum. Interactive sessions and special lectures from industrial personnel are being conducted during the course. Moreover, there has been an active interactive forum between current students and their alumni who are well placed in eminent industries, or engaged in R & D etc. Our alumni members are making us proud while working in prestigious organizations as follows:

ITC papers (Tribeni), Yash Papers Ltd., BILT (Yamunanagar), JK Papers (Rayagada), International Papers (formerly APPM), Century Pulp & Paper, Trident (Punjab), Star Papers (Saharanpur) and various other eminent organizations.



## CENTRAL PULP AND PAPER RESEARCH INSTITUTE

### Introduction

Central Pulp and Paper Research Institute (CPPRI) is a premier research institute dedicated to the service of pulp, paper and allied industry. The institute prides itself of having state of art facilities and equipments and an enthusiastic team of dedicated, well experienced and trained scientists for carrying out quality research work in various areas of pulp & paper making i.e. from raw material to finished product. Over the years, the Institute has carved a niche and is considered at par with the reputed research organizations of developed countries like Sweden, Finland etc. The Institute is located at Saharanpur and the reputed institutions like Department of Paper Technology (IIT-Roorkee). The Star Paper Mills Ltd. and Indian Pulp & Paper Technical Association (IPPTA) are located in close vicinity of CPPRI.



### Objective of the Institute

- To develop into a centre of excellence for providing technical and consultancy services and carrying out quality research and scientific work dedicated to pulp & paper and allied industry.
- To strive towards improving the overall technological and environmental status, global competitiveness

and environmental sustainability of Indian Pulp and Paper Mills.

- Information dissemination related to latest R&D and technological developments in paper industry and impart training to mill personnel for upgradation of knowledge and skill in various aspects of paper making.

## Infrastructure

The institute has a lush green campus and the constructed area is 10712 square meters, which includes:

- The main building comprising of Administrative Block and two Laboratory Blocks.
- Pilot Plant
- Library and Documentation Centre
- Hostel-cum-Guest House etc.
- Residential complex with 69 residential quarters

The Institute renders its services in various areas of pulp and paper making and caters to the need of the paper industry through its divisions which are well equipped with state of art equipments and facilities to carry out quality research work and render technical services to pulp, paper and allied industries.

## Divisions of the CPPRI

### 1. Physical Chemistry, Pulping & Bleaching Division (PCPB)

#### Objectives:

- Undertake R&d work on raw material handling & preparation, quality improvement including reduction of chemical pulp production cost in terms of yield and bleaching chemicals
- Better understanding of pulping and bleaching processes & quality improvements.
- Provide technical services to paper industries, government agencies and other organizations in the area of chemical analysis of fibrous raw materials, fiber characterization, fibre furnish analysis of paper and board and analysis of chemicals used in papermaking

### 2. Paper Testing & Energy management Division

#### Objectives:

- Render technical services to paper mills, paper converters, printing & publication houses, chemical & machinery suppliers in quality assessment and development of paper testing instruments & conduct energy & process audits in industries
- Assistance to various government agencies in quality assessment of paper.
- Provide training to mill personnel at all levels, demonstration of technology, organizing workshop, seminar & interaction meets to disseminate information.



- Assist other agencies like CII, MNES, Ministry of Power, Paper Mill Associations etc., for preparation of pre-feasibility reports, technological evaluation etc.

### 3. Chemical Recovery, Biotechnology & Lignin by-products

#### Objectives:

- Undertake R&D work in the area of chemical recovery, desilication, thermal treatment of black liquor for viscosity reduction, black liquor characterization.
- Development of alternate technologies in the area of chemical recovery for cost-effective production, viable in Indian context
- Act as a nodal agency between various R&D Institute, enzyme manufacturers and Pulp & Paper Industry for biotechnological application in Pulp & paper.
- Provide technical services to Pulp & Paper allied industries for chemical characterization of organic samples by employing instrumental methods of analysis. And mill personal of all levels.

### 4. Pilot Plant & International Cooperation, Stock Preparation, Paper Making, Recycling & Conversion.

#### Objectives:

- Conduct applied research related to Stock Preparation wet end optimization, Paper Making, coating and quality improvement.
- Conduct R&D work on alkaline/neutral/enzymatic deinking, bleaching and contaminant removal technologies for adoption by RCF based mills.
- Quantify and control stickies generation and accumulation in RCF stock.
- Application of enzymes, oxygen and ozone for quality up gradation of RCF pulps.
- Performance evaluation and trouble shooting of RCF based mills.
- Provide consultancy & technical services of RCF based mills, Chemical suppliers, scrap dealers & overseas clients.
- Establish mechanism to enhance recovery rate of indigenous RCP.

### 5. Environment Management Section

#### Objectives:

- Generation of data base on pollution load in pulp & paper industries.



- Physico-chemical treatment of pulp & paper mill effluents.
- Optimisation of process parameters to improve the efficiency of ETP.
- Development of cost effective methods for treatment of wasters including liquid & solid wasters and air pollutants & Water conservation & odor control in paper industry.
- Utilisation of black liquor/Solid waste or conversion to value added products.

## 6. Energy Management Cell

### Objective:

- Assisting BEE, Ministry of Power for implementation of perform achieve and trade (PAT) scheme in pulp & Paper Sector.
- Engaged in activities related to energy conservation an process optimization for cost effective production.

## 7. Recycled Fibre Processing & Paper Making

### Objective:

- Stickies Audit
- Evaluation of Deinking chemicals and Natural polymer for strength improvement
- Evaluation of Sizing Chemicals&Synthetic polymer for strength improvement
- Evaluation of market RCF pulp/moulded tray for fibre quality
- Evaluation of Bleaching Chemicals to remove color & Fluorescence

## 8. Biotechnological Applications in Pulp & Paper Industry

### Objective:

- Biofuels-Form lignocellulosic waste biomass.
- Enzymatic Prebleaching of Pulp& Enzyme Applications in banana fibre processing
- Enzymatic Deinking-Cost Effective Technology For Recycled fibre Mills
- Enzymatic refining-fibre modification&Biological effluent treatment

## 9. Human Resource Development

HRD programmes and continuing education are important in strengthening the capability of the Indian paper industry, so that the industry could equip itself to compete in the changing scenario.

The Institute formulates every year different courses such as short term courses (STC) which involved group training by way of lectures & practical exposures. It also serves as a meeting ground to exchange ideas among the industry personnel having varied practical experience. Contact training programmes (CTP) will involve practical training in specific subjects (s). On-site training programmes (OTP) will involve the visit of CPPRI scientist to the mill site, where they will deliver the lectures & provide comprehensive training documents.



**FOREST RESEARCH INSTITUTE DEEMED TO BE UNIVERSITY**

(Indian Council of Forestry Research and Education)

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Website: [www.fridu.edu.in](http://www.fridu.edu.in)

**M. Sc. Cellulose & Paper Technology  
Batch-2017-19**



This Brochure was Designed By - Dr. Vikas Rana (Course Co-ordinator) Dr. Salil Dhawan ( Placement Officer),  
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Stock Preparation, Paper Machine,  
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Hobbies: Cricket, Travelling.



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**Area of Interest:**

Pulping & Bleaching, Raw materials,  
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## STUDENT'S PROFILE (2017-19)



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**Area of Interest:**

R&D and Marketing.  
Hobbies: Sports, Travelling



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**Area of Interest:**

Marketing, R&D, Paper Testing &  
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Hobbies: Travelling, Learning new languages.



**KUNAL**

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**Area of Interest:**

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Hobbies: Table Tennis, Volleyball, Cricket.



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Paper Machine, Chemical Recovery R&D  
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Hobbies: Watching cricket.



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Hobbies: Cooking, Travelling.



**PALLAB MANDAL**

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Edu: B.Sc. in Chemistry (Hons.),

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**Area of Interest:**

Innovative Paper Product Designing,  
Paper Machine, Chemical Recovery &  
Papermaking Chemistry.

Hobbies: Creative writing, Football.

## STUDENT'S PROFILE (2017-19)



**SAKSHI MISHRA**

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Edu: B.Sc. in Botany (Hons.), Chemistry  
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**Area of Interest:**

Paper Testing, Marketing & Paper Chemicals.

Hobbies: Singing.



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Edu: B.Sc. in Industrial Chemistry,  
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**Area of Interest:**

Paper Machine, Paper Testing &  
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Hobbies: Sports.



**VIKAS SAINI**

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Edu: B.Sc. in Industrial Chemistry,  
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**Area of Interest:**

Paper Machine, R&D, Chemical  
Recovery & ETP.

Hobbies: Cricket, Volleyball.



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**Area of Interest:**

R&D, Marketing, Paper Testing &  
Chemical Recovery.

Hobbies: Singing.



**Industrial Visit 2017**

# PLACEMENT OPPORTUNITY DETAILS

Name of Organisation/Company: .....

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Contact Person: .....

Designation: .....

Address for Communication: .....

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Phone: .....

Fax: .....

Email: .....

Functional Area .....

Location .....

No. of Candidates Required .....

Gross Salary .....

Take Home .....

Other Perks .....

Job Description (in brief): .....

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Tentative Date Of Visit to FRI Deemed to Be University: .....

No. of Persons Visiting for whom accommodation is required .....

Comments/Queries if any: .....

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Date: .....

Signature

Place: .....

Name: .....

Designation: .....