INDIAN INSTITUTE OF TECHNOLOGY ROORKEE

NAME OF DEPARTMENT/CENTRE/SCHOOL: Department of Paper Technology

Subject Code: PPC-501 **Course Title:** Pulping

L-T-P: 3-0-2/2 **Credits:** 3 **Subject Area:** PCC

Course outlines: Raw material procurement, fundamentals of Pulping, mechanical and chemical pulping, process modification, chemistry of pulping, H-factor, control parameters, processing techniques, pulp characterization, Kappa number, batch, continuous and super batch digesters, hot and cold blowing system, heat recovery system.

INDIAN INSTITUTE OF TECHNOLOGY ROORKEE

NAME OF DEPARTMENT/CENTRE/SCHOOL: Department of Paper Technology

Subject Code: PPC-503 **Course Title:** Washing and Bleaching

L-T-P: 2-0-2/2 **Credits:** 2 **Subject Area:** PCC

Course outlines: Fundamental concept of Washing and Bleaching, brown stock washing, process design calculations, quality control of pulp, reaction kinetics and process variables, material balance, process flowsheets, types of pulp bleaching agents, chlorine-free bleaching, bleached pulp characterization, different sequences of bleaching, processing of secondary fiber, deinking process, floatation process.

INDIAN INSTITUTE OF TECHNOLOGY ROORKEE

NAME OF DEPARTMENT/CENTRE/SCHOOL: Department of Paper Technology

Subject Code: PPC-505 **Course Title:** Chemical Recovery Process

L-T-P: 2-0-2/2 **Credits:** 2 **Subject Area:** PCC

Course outlines: Terminology, black liquor characterization, concentration of black liquor, single & multiple effect evaporators, process design calculations, state-of-the-art recovery boiler, material and energy balance, recycling of pulping chemicals, electricity and steam generation, environmental challenges, ESP design, white liquor analysis, causticizing and slaking, Sedimentation, lime mud re-burning, alternative chemical recovery process.

INDIAN INSTITUTE OF TECHNOLOGY ROORKEE

NAME OF DEPARTMENT/CENTRE/SCHOOL: Department of Paper Technology

Subject Code: PPC-507 **Course Title:** Paper Making

L-T-P: 2-0-2/2 **Credits:** 2 **Subject Area:** PCC

Course outlines: Background and trends in papermaking, save all, stock dilution, approach flow system, bale handling, broke line system, water and energy balance, process optimization, evolution of headbox, process design calculations, flow distribution system, drainage systems, white water system, wet end and dry end operations: forming, pressing, drying and calendaring safety constraints.

INDIAN INSTITUTE OF TECHNOLOGY ROORKEE

NAME OF DEPARTMENT/CENTRE/SCHOOL: Department of Paper Technology

Subject Code: PPC-509 **Course Title:** Stock Preparation

L-T-P: 2-0-0 **Credits:** 2 **Subject Area:** PCC

Course outlines: Thermodynamics of cellulose water system, colloidal chemistry, fibre-water bonding, zeta potential, fibrillation, pulp refining, wet and dry strength additives, process parameters: retention and drainage aids, material and energy balance, foam and slime control.

INDIAN INSTITUTE OF TECHNOLOGY ROORKEE

NAME OF DEPARTMENT/CENTRE/SCHOOL: Department of Paper Technology

Subject Code: PPC-511 **Course Title:** Paper Properties

L-T-P: 2-0-0 **Credits:** 2 **Subject Area:** PCC

Course outlines: BIS and ISO standards, different grades of paper, physical properties, mechanical properties, optical properties, barrier properties, correlation of properties, Environmental impacts and permanence of paper, Quality Assurance and Control.

INDIAN INSTITUTE OF TECHNOLOGY ROORKEE

NAME OF DEPARTMENT/CENTRE/SCHOOL: Department of Paper Technology

Subject Code: PPC-513 **Course Title:** Stock Preparation and Paper Properties

L-T-P: 0-0-6 **Credits:** 3 **Subject Area:** PCC

Course outlines: Beating and refining, °SR, sizing, papermaking, optical properties, mechanical properties, physical properties, barrier properties, printability, coating, calendaring, variation in MD and CD.

INDIAN INSTITUTE OF TECHNOLOGY ROORKEE

NAME OF DEPARTMENT/CENTRE/SCHOOL: Department of Paper Technology

Subject Code: PPC-521 **Course Title:** Packaging Principles, Processes and Sustainability

L-T-P: 2-0-0 **Credits:** 2 **Subject Area:** PCC

Course outlines: Objective of packaging, packaging materials and forms, package production, food packaging, packaging operations and machinery, in-process controls, packaging sustainability.

INDIAN INSTITUTE OF TECHNOLOGY ROORKEE

NAME OF DEPARTMENT/CENTRE/SCHOOL: Department of Paper Technology

Subject Code: PPC-523 **Course Title:** Packaging Materials

L-T-P: 3-0-2/2 **Credits:** 3 **Subject Area:** PCC

Course outlines: Paper and board, paper and board for packaging, converted products, glass and metals, introduction to polymer, polymerization and copolymerization, polymers for films and sheets, mechanical properties of polymer, polymer surface and interface, high performance polymers.

INDIAN INSTITUTE OF TECHNOLOGY ROORKEE

NAME OF DEPARTMENT/CENTRE/SCHOOL: Department of Paper Technology

Subject Code: PPC-525 **Course Title:** Converting Processes for Packaging

L-T-P: 3-0-0 **Credits:** 3 **Subject Area:** PCC

Course outlines: Paper and board converting, coating, web fed converting operations, injection molding, blow molding, compression molding, processing, transfer molding processes, miscellaneous processing technologies, tooling & molds tool making processes.

INDIAN INSTITUTE OF TECHNOLOGY ROORKEE

NAME OF DEPARTMENT/CENTRE/SCHOOL: Department of Paper Technology

Subject Code: PPC-527 **Course Title:** Package Performance

L-T-P: 0-0-6 **Credits:** 3 **Subject Area:** PCC

Course outlines: Hazard in packaging, standard organization for packaging test performance, general performance evolution, testing of performance of packaging during shipping and transport, specific performance criteria for major packaging industry.

INDIAN INSTITUTE OF TECHNOLOGY ROORKEE

NAME OF DEPARTMENT/CENTRE/SCHOOL: Department of Paper Technology

Subject Code: PPC-529 **Course Title:** Package Design

L-T-P: 2-0-0 **Credits:** 2 **Subject Area:** PCC

Course outlines: Aspects of package design, functional of product and package design, graphic design, functional requirement of package, structural design aspects, software of design, economics of design, road map of package design, concept development.

INDIAN INSTITUTE OF TECHNOLOGY ROORKEE

NAME OF DEPARTMENT/CENTRE/SCHOOL: Department of Paper Technology

Subject Code: PPC-531 **Course Title:** Food and Pharmaceutical Packaging

L-T-P: 3-0-0 **Credits:** 3 **Subject Area:** PCC

Course outlines: Function of packaging, factor effecting food and pharmaceutical packaging, packaging property & standard testing procedure, processing of packaging material for food and pharmaceutical, sterilization & testing, typical food packing structure & testing, typical pharmaceutical packaging structure & testing, health care packaging, packaging waste and waste policy.

INDIAN INSTITUTE OF TECHNOLOGY ROORKEE

NAME OF DEPARTMENT/CENTRE/SCHOOL: Department of Paper Technology

Subject Code: PPL-501 **Course Title:** Process Equipment and Design

L-T-P: 3-0-0 **Credits:** 3 **Subject Area:** PEC

Course outlines: Stress-strain relationships, failure theories, pressure vessel codes, equipment selection, cylindrical and spherical shell design, materials of construction, tall tower design, piping thickness, supports storage tank classification, recovery boiler and evaporator design, inspection, testing, piping system, flexibility analysis, safety and loss prevention.

INDIAN INSTITUTE OF TECHNOLOGY ROORKEE

NAME OF DEPARTMENT/CENTRE/SCHOOL: Department of Paper Technology

Subject Code: PPL-502 **Course Title:** Pulp Mill Calculations

L-T-P: 3-0-0 **Credits:** 3 **Subject Area:** PEC

Course outlines: Material and energy balance, raw material properties, pulping process calculations, steam and power requirements, screening and cleaning efficiencies, bleaching system design, recovery section calculations, evaporator and condenser sizing, lime mud reburning, stock pump and piping dimensions.

INDIAN INSTITUTE OF TECHNOLOGY ROORKEE

NAME OF DEPARTMENT/CENTRE/SCHOOL: Department of Paper Technology

Subject Code: PPL-503 **Course Title:** Paper Mill Calculations

L-T-P: 3-0-0 **Credits:** 3 **Subject Area:** PEC

Course outlines: Mass balance, approach flow system, headbox pressure and flow calculations, drainage rate, water and fiber balance, vacuum calculation, energy requirements, pressing rolls dimensions, material and energy balance, Yankee dryer sizing, and pump and piping specifications.

INDIAN INSTITUTE OF TECHNOLOGY ROORKEE

NAME OF DEPARTMENT/CENTRE/SCHOOL: Department of Paper Technology

Subject Code: PPL-504 **Course Title:** Chemical Recovery Process Calculations

L-T-P: 3-0-0 **Credits:** 3 **Subject Area:** PEC

Course outlines: Material and energy balances, multiple effect evaporators, recovery boiler performance, condenser and ejector design, electrostatic precipitators, causticizing section calculations, slakers and clarifiers design, mud washing, and lime mud reburning system efficiency and performance metrics.

INDIAN INSTITUTE OF TECHNOLOGY ROORKEE

NAME OF DEPARTMENT/CENTRE/SCHOOL: Department of Paper Technology

Subject Code: PPL-506 **Course Title:** Bio-Process and its Application

L-T-P: 3-0-0 **Credits:** 3 **Subject Area:** PEC

Course outlines: Biotechnology fundamentals, genetic engineering applications, white-rot fungi in enzyme production, fermentation, wood pretreatment, bio-debarking, bio-pulping and bio-bleaching, enzymatic fiber modification, fuel generation, effluent treatment for wastewater purification.

INDIAN INSTITUTE OF TECHNOLOGY ROORKEE

NAME OF DEPARTMENT/CENTRE/SCHOOL: Department of Paper Technology

Subject Code: PPL-507 **Course Title:** Electro kinetics in Paper Making

L-T-P: 3-0-0 **Credits:** 3 **Subject Area:** PEC

Course outlines: Colloidal systems in papermaking, particle motion in liquid media, fiber and filler charge factors, pH and electrolyte effects, electrokinetic phenomena, charge measurement techniques, zeta potential, sorption, coagulation and flocculation, retention mechanisms in foam/slime control.

INDIAN INSTITUTE OF TECHNOLOGY ROORKEE

NAME OF DEPARTMENT/CENTRE/SCHOOL: Department of Paper Technology

Subject Code: PPL-508 **Course Title:** Coated and Specialty Papers

L-T-P: 3-0-0 **Credits:** 3 **Subject Area:** PEC

Course outlines: Coating base paper, mechanical papers, coating pigments, coating binders, modifiers, writing papers, absorbent grade paper, wrapping paper, packaging paper, carton boards, tissue papers, air-laid papers, industrial specialty papers, process control, multiple coating, drying, troubleshooting, Different value-added paper grades.

INDIAN INSTITUTE OF TECHNOLOGY ROORKEE

NAME OF DEPARTMENT/CENTRE/SCHOOL: Department of Paper Technology

Subject Code: PPL-509 **Course Title:** Risk Analysis and Management in Industry

L-T-P: 3-0-0 **Credits:** 3 **Subject Area:** PEC

Course outlines: Environmental hazards, risk types, assessment framework, risk analysis, chemical handling, chemical hazards, material handling, equipment safety, hazard identification, dose-response evaluation, risk characterization, exposure assessment, toxicological studies, industrial hygiene, Hygiene laws and regulations, fire prevention, explosion prevention, safety reviews, risk management and assessment methods.

INDIAN INSTITUTE OF TECHNOLOGY ROORKEE

NAME OF DEPARTMENT/CENTRE/SCHOOL: Department of Paper Technology

Subject Code: PPL-510 **Course Title:** System Closure

L-T-P: 3-0-0 **Credits:** 3 **Subject Area:** PEC

Course outlines: Sustainability concepts, challenges in paper manufacturing, emissions standards, environmental impact assessment, eco-labelling, life cycle analysis, energy management, Concepts of process integration, pinch technology, Thermodynamics, water sourcing, closed systems, renewable energy, waste management, energy management, water management, non-process element management.

INDIAN INSTITUTE OF TECHNOLOGY ROORKEE

NAME OF DEPARTMENT/CENTRE/SCHOOL: Department of Paper Technology

Subject Code: PPL-512 **Course Title:** Papermaking Chemistry

L-T-P: 3-0-0 **Credits:** 3 **Subject Area:** PEC

Course outlines: Papermaking kinetics, fiber bonding theories, factors affecting bonding, bond measurement, sorption, swelling of cellulose, types of adsorptions, Effect on electrokinetic properties, coagulation, flocculation, retention mechanisms, effect of additives, charge neutralization, foam control, foam stabilization, and slime management.

INDIAN INSTITUTE OF TECHNOLOGY ROORKEE

NAME OF DEPARTMENT/CENTRE/SCHOOL: Department of Paper Technology

Subject Code: PPL-513 **Course Title:** Process Integration in Pulp and Paper Industry

L-T-P: 3-0-0 **Credits:** 3 **Subject Area:** PEC

Course outlines: Process integration, thermodynamics, energy targeting, area optimization, cost reduction, water networking, pinch technology, heat exchanger network analysis, maximum energy recovery, heat-integrated distillation, wastewater minimization, flue gas targeting, heat and power integration, increasing process efficiency, Case studies (Black liquor evaporator, cylinder drying, distillation).

INDIAN INSTITUTE OF TECHNOLOGY ROORKEE

NAME OF DEPARTMENT/CENTRE/SCHOOL: Department of Paper Technology

Subject Code: PPL-514 **Course Title:** Environmental Management

L-T-P: 3-0-0 **Credits:** 3 **Subject Area:** PEC

Course outlines: Sustainable development, Environmental policies and legislation, effluent management, air pollution control, solid waste management, Pollution case studies, pollution abatement remedies, energy management, conservation and efficiency, industrial energy efficiency.

INDIAN INSTITUTE OF TECHNOLOGY ROORKEE

NAME OF DEPARTMENT/CENTRE/SCHOOL: Department of Paper Technology

Subject Code: PPL-515 **Course Title:** Printing Operations

L-T-P: 3-0-0 **Credits:**3 **Subject Area:** PEC

Course outlines: Printing process, Pulp Molding, Characterization and Composition of ink, ink balance, Printing techniques, Color Engineering and Innovation, Color matching and mixing, mathematical analysis of color correction, color separation, halftone production.

INDIAN INSTITUTE OF TECHNOLOGY ROORKEE

NAME OF DEPARTMENT/CENTRE/SCHOOL: Department of Paper Technology

Subject Code: PPL-516 **Course Title:** Packaging Papers and Boards

L-T-P: 3-0-0 **Credits:**3 **Subject Area:** PEC

Course outlines: Packaging innovation, flexible and rigid packaging, paper making, recycled paper and paper board, process and quality control, coating formulations, Packaging Processes and modification, rheology of coating polymers, coating techniques, lamination

INDIAN INSTITUTE OF TECHNOLOGY ROORKEE

NAME OF DEPARTMENT/CENTRE/SCHOOL: Department of Paper Technology

Subject Code: PPL-518 **Course Title:** Robotics and Automated Packaging

L-T-P: 3-0-0 **Credits:** 3 **Subject Area:** PEC

Course outlines: Robotics and process control systems in packaging, probes in robotics and process control, machine vision, control and integration, design & development of automated and robotics packaging system, application of automation and robotics in packaging.

INDIAN INSTITUTE OF TECHNOLOGY ROORKEE

NAME OF DEPARTMENT/CENTRE/SCHOOL: Department of Paper Technology

Subject Code: PPL-521 **Course Title:** Hazardous Material Packaging

L-T-P: 3-0-0 **Credits:** 3 **Subject Area:** PEC

Course outlines: Hazardous materials, classification of hazardous materials, global regulations, regulation on packing material of dangerous materials, customer service and logistics, regulation on size and weight of dangerous material packaging, packaging recommendation for dangerous goods and testing, safety in packaging and moving of dangerous materials, route map of packing hazardous materials.

INDIAN INSTITUTE OF TECHNOLOGY ROORKEE

NAME OF DEPARTMENT/CENTRE/SCHOOL: Department of Paper Technology

Subject Code: PPL-524 **Course Title:** Nanotechnology Application in Packaging

L-T-P: 3-0-0 **Credits:** 3 **Subject Area:** PEC

Course outlines: Introduction, function of nanomaterial in packaging, applications of nanotechnology, nanomaterials in packaging, polymers, nanocomposites and ink in packaging and its processing, some example of nanopackaging materials, nanotechnology, testing, regulation & safety.

INDIAN INSTITUTE OF TECHNOLOGY ROORKEE

NAME OF DEPARTMENT/CENTRE/SCHOOL: Department of Paper Technology

Subject Code: PPL-528 **Course Title:** Logistics and Supply Chain Management

L-T-P: 3-0-0 **Credits:** 3 **Subject Area:** PEC

Course outlines: Concept of logistics, overview of supply chain management, integrated logistics and supply chain, strategic supply chain management, customer service and logistics, customer value, service and channel strategies in supply chain, key issues, challenges, planning and process, value of information and order management in logistics and supply chain, transportation and fleet management, warehousing and material management, procurement management, strategic souring and out-sourcing management, performance measurement of logistics and supply chain.