K A N N U R U N I V E R S I T Y

(Abstract)

M.Sc Programme in Wood Science & Technology –Scheme & Syllabus under Choice based Credit Semester System– Implemented with effect from 2010 Admission – Orders issued.

ACADEMIC BRANCH

U.O.No.Acad/C2/8773/2008. Dated, K.U.Campus.P.O, 09-12-2010.

Read:1. U.O.No.Acad/C2/8773/2008 dated 29-10 -2008.

2. Minutes of the meeting of the Curriculum Committee held on 05-06-2010 & 16-08-2010.

3. U.O No Acad/C3/2049/2009 dated 11-10-2010.

4. Letter dated 16-08-2010 from the Course Director (i/c), School of Wood Science & Technology, Talap Vayal, Kannur.

ORDER

1.The Scheme and Syllabus of M.Sc Wood Science & Technology Programme under Credit and Semester System are implemented in this University with effect from 2008 admission vide paper read (1) above.

2.The Curriculum Committee as per paper read (2) above, recommended modifications to the regulations of Credit Semester System. As per the above recommendation the regulations were revised and implemented in this University with the nomenclature 'Choice based Credit Semester System' with effect from 2010 admission as per paper read (3) above.

3.The Course Director(i/c) of the School of Wood Science & Technology, vide paper read (4), has forwarded the revised scheme and syllabus for M.Sc Programme in Wood Science & Technology in line with the revised regulations for Choice based Credit Semester System, for implementation with effect from 2010 admission.

4. The Vice Chancellor, after considering the matter in detail, and in exercise of the powers of the Academic council, conferred under section 11(1) of Kannur University Act 1996 and all other enabling provisions read together with, has accorded sanction to implement the revised scheme and syllabus of M.Sc Programme in Wood Science & Technology under Choice based Credit Semester System with effect from 2010 admission, subject to report to the Academic Council.

5. The following orders are therefore issued in this matter:

(i) ***The revised Scheme and Syllabus of M.Sc Programme in Wood Science & Technology under Choice based Credit Semester System is implemented in this University with effect from 2010 admission onwards.***

(ii) ***The Regulation for Choice based Credit Semester System implemented vide paper read (3) above will be applicable for the revised Scheme and Syllabus of M.Sc Programme in Wood Science & Technology implemented vide this order.***

6. The revised Scheme and Syllabus of M.Sc Programme in Wood Science & Technology effective from 2010 admission are appended.

Sd/-

REGISTRAR

To

1. The Course Director (i/c), School of Wood Science & Technology.
2. The Examination Branch (through PA to CE).

Copy to:

1. PS to VC/PA to PVC/PA to Registrar.
2. DR/AR-I (Academic).
3. SF/DF/FC.

Forwarded/By order

SECTION OFFICER

Appendix to U.O No Acad/C2/8773/2008 dated 09-12-2010.

K A N N U R U N I V E R S I T Y

SCHEME AND SYLLABUS

FOR

M.Sc PROGRAMME

IN

WOOD SCIENCE AND TECHNOLOGY

Choice based Credit Semester System

WITH EFFECT FROM 2010 ADMISSION

ELIGIBILITY FOR ADMISSION

As per the regulations prescribed by the University for the M.Sc. Wood Science and Technology Programme, Candidates with Bachelor Degree in Chemistry/ Chemical Sciences/Physics/Botany/Plant Science/Forestry/Micro Biology/Biotechnology/Mathematics with at least 50% marks in the concerned optional subjects excluding Subsidiaries are eligible for admission to this course. Rules regarding minimum marks required for Bachelor Degree, reservation etc., will be as laid down by the University from time to time. A pass in the Degree for candidates belonging to SC/ST categories, 45% for OEC and 47% for OBC. 5% of index marks will be awarded to the students having degree in Biology related subjects.

ADMISSION

As per the regulations prescribed by the University for the M.Sc. Wood Science and Technology Programme Selection of the students will be based on the marks secured by them in the qualifying examinations (50%) and based on the marks in the entrance test (50%).

NOTE

The regulations of Choice based Credit Semester System for PG Programmes implemented with effect from 2010 admission will be applicable to this Programme also and if there is any inconsistency between the regulations and its application to M.Sc Wood Science & Technology Programme, the former shall prevail.

SCHEME
(w.e.f 2010 admissions)

I Semester

SL No.	Course Code	Course Title	Contact Hrs/Week			Mark			Credit
			L	T/S	P	ESE	CE	TOTAL	
1	WST C001	Forestry and Forest Botany	2	1	3	60	40	100	3
2	WST C002	Wood Structure and Identification	2	1	3	60	40	100	3
3	WST C003	Wood Chemistry	2	1	3	60	40	100	3
4	WST C004	Statistical methods and Computer Application	2	1	3	60	40	100	3
5	WST E005	Wood Physics	2	1	3	60	40	100	3
6	WST E006	Forest Management and Working Plan	2	1	--	60	40	100	3
	Total Credits: Core: 12 Elective: 6								

II Semester

Sl. No	Course Code	Course Title	Contact Hrs/Week			Mark			Credit
			L	T/S	P	ESE	CE	TOTAL	
1	WST C007	Wood Biodegradation	2	1	3	60	40	100	3
2	WST C008	Wood Seasoning	3	1	3	60	40	100	4
3	WST C009	Adhesives for Wood Panel Products	3	1	3	60	40	100	4
4	WST C010	Management Principles	3	2	--	60	40	100	3
5	WST E011	Functional Environment	3	2	--	60	40	100	3
6	WST E012	Environment, Ecology and Global Warming related to Wood Industry	2	1	3	60	40	100	3
	Total Credits: Core: 14 Elective: 6								

Open Course (II Semester)

1	WST O 025	Forestry and Forest Products - the Ecological Perspectives	3	1	--	60	40	100	3

Department offers FORESTRY AND FOREST PRODUCTS - THE ECOLOGICAL PERSPECTIVES as Open Course in the Second Semester.

III Semester

SL NO	Course Code	Course Title	Contact Hrs/Week			Mark			Credit
			L	T/S	P	ESE	CE	TOTAL	
1	WST C013	Wood Preservation	2	1	3	60	40	100	4
2	WST C014	Veneer, Plywood and Composites	2	1	3	60	40	100	3
3	WST C015	Reconstituted Wood Panels	2	1	3	60	40	100	4
4	WST C016	Wood Mechanics and Timber Grading	2	1	3	60	40	100	4
5	WST E017	Production Management	2	1	--	60	40	100	3
6	WST E018	Advanced Coatings for Wood and Other Substrates	2	1	--	60	40	100	3
7	WST C019	Industrial Placement and Report Submission	3 Hrs/Week			30	20	50	6
	Total Credits: Core: 21 Elective: 6								

IV Semester

Sl. No	Course Code	Course Title	Contact Hrs/Week			Mark			Credit
			L	T/S	P	ESE	CE	TOTAL	
1	WST C020	Pulp and Paper	3	1	3	60	40	100	3
2	WST C021	Saw milling and Saw Doctoring	3	1	3	60	40	100	4
3	WST E022	Wood Working and Wood Finishing	3	1	3	60	40	100	3
4	WST E023	Timber Engineering and Construction	3	1	--	60	40	100	3
5	WST C024	Dissertation and Comprehensive Viva Voce	9 Hrs/Week			90	60	150	14
	Total Credits: Core: 21 Elective: 6								

WST C 001 FORESTRY AND FOREST BOTANY

A. Theory

Introductory Forestry: -

Forest types, tangible and intangible benefits of forests.

Silvicultural systems, sustainable forest management. Man made forests (Plantations), Formation - Site and species selection, planting and maintenance, thinning, rotation, extraction etc.

Forest Plantations- different types- monoculture, polyculture plantations and softwood, hardwood, and mixed plantations, interplanting etc.

Forest genetics and plantation improvement - especially yield.

Plantations of forest species In Government or other public lands outside Reserved Forests.

Social forestry and its aims.

Forest conservation - problems and prospects, extension activities in forest conservation. PeopIe's participation In forest conservation and management; management of village wood lands. Timber working and disposal — extraction , transport, depot management, grading of timber, pricing, auctioning, or other types of marketing, allotment to Industries, pricing etc.

Demand and supply of wood.

Local and industrial consumption of wood and other forest products.

Wood based Industries Including handicraft; their distribution and marketing. Bamboos, Reeds, and sandalwood – resource base, availability, Industrial utilization and end products. Local demand for wood and other forest produce. Wastage of wood in harvesting, storage and service.

Forestry research-Research Institutions in India- their formation, organization, management and the research activities. Central and State rules relating to forest and timber transit.

National Forest Policy.

Forest Botany

Taxonomy and its relevance to wood science. Plant nomenclature: Systems of classification (Binomial, Numerical and phylogenetic). International Code of Botanical Nomenclature. Linnaean system of classification.

Distribution, characteristics and main uses of prominent species of 10 important timber producing families (Verbenaceae, Leguminosae, Dipterocarpaceae, Lythraceae, Meliaceae, Combretaceae, Ebenaceae, Salicaceae, Betulaceae & Pinaceae). Modern trends in plant taxonomy: Wood anatomy In relation to taxonomy; Cytology in relation to taxonomy, Chemotaxonomy, Floral taxonomy, Embryology, Numerical taxonomy, Palynology. Taxonomic identification tools: bark, stem, leaf, flower, fruit, seed.

B. Practical

Introductory Forestry - Practical; in the form of visits/tours. - 7 Days

Tour to natural forest area: (Silent Valley preferred): Study of succession, Forest types, forest functions, biosphere and ecosystem management, field identification of forest trees, measurement of standing trees and volume calculation by laying plots etc. - 2 Days

Visit to plantations: Plantations of different species and study their management · 1Day

Visit to Teak plantations (Nilambur final felling areas): Calculation of standing volume, extraction methods, Field classification and storage, different permits systems 1 Day

Tour to Government Depots: Timber stock taking, depot classification or grading, sale, delivery and removal from depot - 1 Day.

Tour to Social Forestry areas:

Study of social forestry plantations, homestead forestry, farm forests, participatory forestry, avenue planting, problems faced by people Involved in social forestry activities, coastal forestry etc. — 1 Day Visit

to Forest Conservators' Head Quarters: _ Study the forest organization and administration and its various functions, Coordination between different wings · 1 Day

Forest Botany 1. Morphological studies of leaf, flower and fruit, seed of some important timber species; bole, crown, buttress, bark, blaze. **2**. Making of Herbarium of Important species. _ Excursion- 2 days. Excursion for Identification of the timber trees of tropical and temperate region - with the keys of families.

Reference

1. Peck. T(2001*), **The international timber trade***, England: Wood Head publishing Ltd.
2. Feirer,L.J.,(1994) ***Wood Technology and Process***, New York: McGraw Hills.
3. Rastogi,V.B.,(2006) ***Fundamentals of Biostatistics***, New Delhi, Ane Books India.
4. Sinha. R. K, (2007), ***Sustainable development striking a balance between economy and ecology***, Jaipur: Pointer Publishers.
5. Taylor,D.J., Green,N.P.O., Stout.G.W.,(1984) ***Biological Science***, Cambridge ,R.Soper
6. Young,R.A., Giese,R.L.,(2003), ***Introduction To Forest Ecosystem Science And Management***, United States Of America, Willey.
7. Unger,A.,Schniewind,A.P.,Unger,W.,(2001),***Conservation OF Wood Articrafts***, Newyork, Springer-Verlag Berlin Heidelberg.
8. Bamber,R.K.,Burley,J.,(1983),***The Wood Properties of Radiata Pine***, England, Common Wealth Agricultural Bureax.
9. Zobel,B.J.,Buijtenen,J.P.,(1989),***Wood Variation its Causes and Control***, New York, Springer-verlag Berlin Heidelberg.
10. Laar, A.V., Akca, A.,(2001***), Forest Mensuration***, Netherlands, Springer.

WST C 002 WOOD STRUCTURE AND IDENTIFICATION

A.Theory

Wood formation - cambium & its derivatives: secondary growth.
General & physical features of wood: Features visible on the cross surface of log- sapwood and heartwood, growth rings & growth marks,. rays, pored and non-pored woods (softwoods and . hardwoods), features visible on longitudinal surface of wood. Color, Luster, odor & taste, weight, grain, texture, figure.
Hand lens features of wood- softwood & hardwood.
Microscopic features of softwoods and hardwoods: diagnostic features useful in identification.
Variability of anatomical structure: Reaction wood; heartwood initiation. Criteria and methods of assessment of wood quality in plantation grown timbers, viz. Eucalyptus &
Popular for pulp and timber end-uses.
Different types of microscopes, their working & utility.
Ultra structure of the wood & techniques. .
Natural defects of wood — knots, reaction wood, other defects due to stress, silica content etc.
Anatomical features of Rubber wood, Bamboo, Canes· & Coconut wood.
Figure in wood.
Juvenile wood and its characteristics.
Wood structure in relation to silviculture, genetics and properties and uses of wood.

B. Practical

1. Hand lens features & identification of wood including computer aided Identification.
2. Microscopic features of wood useful in identification. Maceration, staining, slides preparation, measuring dimensions of tissues.
3. Study of increment core for wood quality.

4. Reaction wood, tension wood.
S. Ultra structure of wood
6. Different types of microscopes & their working.
7. Measurement of fibril angle and proportion of tissues.
8. Structure of Bamboo.

Excursion - 1 Day

Visit to Xylarium

Reference

1. Hon,D.N.S., Shiraishi N.,(2001).***Wood And Cellulosic Chemistry***, New York, MarcelL Dekker,Inc.
2. Panshim,A.J, Zeeauw,C.D.,(1980) ,***Text Book Of Wood Technology***, U S A, Mcgraw Hill Book.
3. Schmidt,O.,(2006),***Wood And Tree Funji Biology Damage Protection And Use***, Germany, Springer-Verlag Berlin Heidelberg.
4. Jeffrey,E.C.,(1985),***The Anatomy Of Woody Plants***, NewDelhi,International Books&Periodicals Supply Service.
5. Hilis,W.E.,(1987),***Heart Wood And Tree Exudates***, Newyork,Springer-Verlag Berlin Heidelberg.
6. Zobel,B.J.,Sprague,J.R.,(1998),***Juvenile Wood In Forest Trees***, Newyork,Springer-Verlag Berlin Heidelberg.
7. Tillman, D.A.,Rossi,A.J.,Kitto,W.D.,(1981),***Wood Combustion Principles Processes and Economics***, New York,Acadamic press inc.
8. Bamber,R.K.,Burley,J.,(1983),***The Wood Properties of Radiata Pine***, England, Common Wealth Agricultural Bureax.
9. Zobel,B.J.,Buijtenen,J.P.,(1989),***Wood Variation its Causes and Control***, New York, Springer-verlag Berlin Heidelberg.
10. Panshin,A.J.,(1980),Text ***Book of Technology Structure, Identification, Properties and Uses of the Commercial Woods***, New York, McGraw-Hill Book Company.

WST C 003 WOOD CHEMISTRY

A. THEORY

Structure and ultra structure of wood anatomical| aspects ultra structure of cell walls. Cell wall components and distribution.

Chemical composition and analysis of wood- survey of chemical components—macromolecular Substances and low molecular weight substances. Analysis of wood. Sampling and sample preparation, Determination of water content. Extractives Inorganic substances.

Delignification methods-Preparation of holocellulose .

Cellulose-constitution and configuration (elementary) B-1-4 gIycosidic Iinkages—Repeating cellulose units-reducing and non-reducing ends-conformation-cellulose in solution (elementary).Molecular weight -Degree of polymerization-Inter-and Intra molecular hydrogen bonds- Polymorphism in cellulose.

Hemicelluloses

nature and classification- Isolation-sugar components of polyoses-Xylans and Mannans of hardwood and softwood—GIucans- Galactans— Pectins.

Lignin-significance and occurrence-Iignification of cell wall- Precursors and their polymerization-Dehydrogenatlon polymer(DHP)- isolation and elementary aspects of structure of lignin - various lnterconnectlng units- Polymeric properties of lignin. Glass transitions. Reactions of lignin.

Chemistry of wood and bark extractives-Extractive of heartwood and softwood. Elementary aspects of terpenes and terpenoids-rosin-fats and waxes—Tall oil. -

Phenolic compounds-Lignans-quinones-tannins-flavanoids. Inorganic substances. `
Uses of technical lignin and hemicelluloses. .
Effect of heat, light and high energy radiationon wood.
Energy from wood residues- wood gasification-giogas from wood.

B. PRACTICAL

1. Preparation of samples for proximate analysis
2. Determination of cold water solubles in wood/lignocellulosic material
3. Determination hot water soluble in wood/Iignocellulosic aterllas
4. Determination of soluble in alcohol-benzene
5. Determination of soluble ln 0.1 N sodium hydroxide
6. Determination of ash content ln wood
7. Estimation of acid soluble lignin
8. Estimation of holocellulose in wood /Iignocellulosic material.

Reference

1. Hakkila.P, (1989), ***Utilization of residual forest biomass***, Germany: Springer Verlay Berlin Heidelberg
2. 1.Hon,D.N.S., Shiraishi N.,(2001).Wood And Cellulosic Chemistry,New York,MarcelL Dekker,Inc.
3. Koshijima,T.,Watanabe.,(2003), ***Association Between Lignin and Carbohydrate in Wood and Other Plant tissue***, Berlin, Springer
4. Bhat,S.V.,Nagasampagi,B.A.,Sivakumar,M.,(2005),***Chemistry of Natural Product***, Mumbai, Narosa
5. Rowell,R.M.,(2005),Hand ***Book Of Wood Chemistry And Composites***, Newyork, Taylor And Francis Group.
6. Kollmann,F.P.,Kuenzi,E.W.,Stamn,A.J.,(1975***) Principles Of Wood Science Volume 2 Wood Based Materials***, Newyork,Springer-Verlag Berlin Heidelberg.
7. Hon,D.N.S.,(1996), ***Chemical Modification Of Lignocellulosic Materials***, Hongkong, Marcel Dekker,Inc.
8. Kennedy,J.F.,Philips,G.O.,Williams,P.A.,(1996)***The Chemistry And Processing Of Wood And Plant Fibrous Materials***, England,Wood Head Publishing Ltd.
9. Hilis,W.E.,(1987),***Heart Wood And Tree Exudates***, Newyork,Springer-Verlag Berlin Heidelberg.
10. Rowe,J.W.,(1989),***Natural Products of Woody Plants I & II*** ,New York,Springer-Verlag Berlin Heidelberg
11. Sjostrom,E.,(1993),***Wood Chemistry Fundamentals and Application***, NewYork,Academic press, inc.

WST C 004 STATISTICAL METHODS & COMPUTER APPLICATION

A. Theory

Statistical Methods

Presentation of univariate data. Introduction, compilation, tabulation and presentation of statistical data; Probability and Probability Functions (Normal, binomial, Poisson's etc.) Central tendency, Dispersion; Skewness and Kurtosis.
Sampling techniques: Simple random sampling with and without replacement; Sampling Intensity, sample size & sampling error; Stratified random sampling; Systematic sampling.

Testing of hypothesis: Sampling distribution: Large sample tests; Confidence interval; T – Tes,Chi square test; F- test, Non-parametric methods.
Analysis of variance, One way classification (fixed effect model); Two way classification (fixed effect model); Analysis of co-variance.
Correlation and regression: Correlation coefficient; Sample regression analysis; Coefficient of determination; multiple regressions.
Design of experiments: Principles of design of experiments: Completely randomized design;
Randomized block design; Latin square design; Introduction to factorial experiments.Computer Application
Introduction to DOS; M.S Office: Word processor, Spread Sheets, PowerPoint; Visual basic; introductory CAD.

B. Practical
1. Solving problems and practical record submission
2. Mini projects to students from the beginning using software for identification of timbers, determination of timber properties etc.

Reference

1. Sinha P K, Sinha P, (2007), ***Computer fundamentals***, NewDelhi: BPB Publications.
2. Gupta. V, (2007), ***Comdex Computer Course kit***, New Delhi: Dream tech Press.
3. Irnein. M.R, Wempen. F, Walkenbach. J, Bucki. L.A, (2007), ***Microsoft Office 2007 bible***, New Delhi: Wiley India Pvt. Ltd.
4. Rangaswamy. R, (1995), ***A text book of agricultural statistics***, New Delhi: New age international publishers.

WST E 005 WOOD PHYSICS

A. Theory

Wood-liquid relations: Moisture content. Hydrogen bonding: crystalline & amorphous zones In cellulose, seat and forms of moisture in wood's sorption, theories of water sorption in wood, heat of wetting, swelling pressure, equilibrium moisture content and fiber saturation point, sorption hysteresis and thermodynamics, methods of measurement of F.S.P. effect of extractives on sorption.
Shrinkage & swelling, anisotropicity & effect of cell ultra structure. Relationship with density and factors causing departures thereof. Liquid tension collapse & its mechanism. Effect of extractives, drying conditions and pre-freezing,. Effect of pre-treatment with hygroscopic and anti-shrink chemicals. Swelling in polar & non-polar Iiquids.
Capillary movement and diffusion of water in wood. Drying of timber as a diffusion problem. Channels for moisture under different mechanism. Theories of drying of wood. Moisture gradient forms in permeable and impermeable woods.
Permeability of wood to gases. Polar and non polar liquids. Channels for fluid flow of soft woods and hardwoods and nature of obstructions in impermeable species. Forces involved in overcoming capillary tension. Equations of flow. Slip, viscous and turbulent flow. Problems in measuring permeability to water. Density , sp. gr., .porosity; specific gravity of wood substance, voids in the dry cell wall, Effect of moisture content of density. Maximum moisture content of wood.
Variation in density, density of early and late wood, effect of growth rings of density.
Thermal properties of wood-thermal expansion, specific heat, thermal conductivity and diffusivity.
Change-of temperature in wood under heating ; equations thereof. Effect of moisture of thermal properties.
Thermal properties of wood composites.

Dimensional changes on heating green wood. Effect of dry and wet heat and heating in presence or absence of air on strength and dimensional stability.
Electrical properties of wood. DC electrical conductivity-effect of moisture content, temperature and extractives. Activation energy associated with electrical conduction. Electro osmosis in green wood.
Voltage breakdown strength. '
Dielectric properties of wood under alternating current and electromagnetic field conditions; effects of Specific gravity., moisture content, temperature and extractives. Principles of Induction and dielectric heating.
Piezo-electric properties of wood and its application. Response of defects to stress waves in timber.
Growth stresses in timber and their measurement. Sound transmission & acoustics in buildings.

B. Practical

1. Moisture content of wood by oven-drying and distillation methods
2. Moisture content of lignocellulosic material by azeotropIc distillation
3. Use of electrical moisture meters
4; Measurement of swelling of wood in water/liquor ammonia
5. Determination of specific gravity of wood
6. Determination of linear and volumetric shrinkage of wood
7. Measurement of dielectric strength. of wood
8. Measurement of radial, tangential and longitudinal swelling and shrinkage of wood

Reference

1. Smith, I.,LANDIS E ,Gong m.,(2003), ***Fracture and fatigue in wood***, England, Wiley.
2. Bucur,V.,(2006), ***Acoustic Of Wood***, France: Springer
3. Panshim,A.J, Zeeauw,C.D.,(1980) ,***Text Book Of Wood Technology***, U S A,Mcgraw Hill Book.
4. Kollmann,F.P.,Kuenzi,E.W.,Stamn,A.J.,(1975***) Principles Of Wood Science Volume 2 Wood Based Materials***, Newyork,Springer-Verlag Berlin Heidelberg.
5. Kollmann,F.P.,Cote,W.A.,(1968),***Principles of Wood Science and Technology 1 Solid Wood***, New York, Springer- Verlag Berlin Heidelberg.

WST E 006 FOREST MANAGEMENT AND WORKING PLAN

Forest management- definition and scope- forest policies and management- object of management- forest Organisation- various classification- sustained yield- concept, scope and limitation- arguments for and against the concept-rotation-definition kind of rotation
Normal forest- definition- concept and factors of normality- in regular and irregular forests- normal age gradation in regular and irregular forests- felling series in selection forest and coppice with standard system- Increment- CAI- MA1 relationship. ‘
Growing stock- concept and definition- determination of growing stock- normal growing stock in regular, shelter, wood system, selection system.
Yield regulation- principle- objective- types of yield- yield regulation in regular forests- various modifications- yield regulation ln irregular forests- regulation based on volume Increment, volume and increment only.
Working plans- Introduction- definitions- objective and scope- preparation of working plans- preliminary working plan report.
Constitution of a working plan divison- field work- compartment histories- maps- working plan maps, stock maps, geology map, regenaration map, forest type map, management map- role of GIS in forest management. r - Method of writing working plan- Part I and Part ll- Use OF Modern tools ln WP preparation.

Reference

1. Young,R.A., Giese,R.L.,(2003), ***Introduction To Forest Ecosystem Science And Management***, United States Of America, Willey.
2. Sinha. R. K, (2007), ***Sustainable development striking a balance between economy and ecology***, Jaipur: Pointer Publishers.
3. Laar, A.V., Akca, A.,(2001***), Forest Mensuration***, Netherlands, Springer.

WST C 007 WOOD BIODEGRADATION

A. Theory `

1.) Degradation due to Insects

Insect pests of natural and plantation forestry, standing and felled trees, timber in storage; converted and fabricated wood in respect of broad leaved and coniferous timber including bamboos.

Biology, life history and extent of damage due to wood boring insects species, Injury and control.

Nature of damage - Galls, Cankers etc. Termites and their importance in forestry. Identification, life history and distribution of major and minor wood destroying termites associated with forest and in building structures. Termite control.

Laboratory testing and evaluation against termites.

Principles and components of pest control. Integrated pest management with respect to forest management: Natural, Nutritional, Biotic, Silvicultural, Mechanical, Physical, Chemical methods of insect control with special emphasis on wood boring pests of felled, stored and converted timber.

Principles and practices in plant protection and quarantine. Laws of Quarantine (Internal and External, port entry Quarantine). Use of pesticides and insecticides. Phytosanitary Certification.

2) Wood Deterioration by fungi `

Types of fungal degradation of wood

Decay Types: White rot. Brown rot, Soft rot Sap stain, moulds, discoloration and blemishes

Essentials of fungal attack on wood: Correlation of functional susceptibility to available OH groups in wood. - Classification of decay fungi attacking wood. Biology of wood decay fungi, life cycle, requirement for survival good growth like nutrition, water relation, temperature,light etc.

Detection of decay: destructive and non—destructive methods. i ·

Symptoms and physical, chemical and microscopic effects of decay. Decay in buildings.

Symptoms, physical, chemical and microscopic effects of stains, discoloration, soft rot and blemishes.

Heart rot in standing timber. Management of timber with heart rot in conifers and hardwoods. Natural decay resistance of timbers and its evaluation: Causes of decay resistance.

3) Wood deterioration by other agents

Decay by bacteria. Wind, rain, temperature, (weathering) effects

Fire, grazing, logging and other wood working tools Creep (failure in service life due to aging)

Chemistry] biochemistry of decay -Ecology of microbial invasion of wood.

4) General

Qualitative and quantitative aspects of wood degradation. -Wood degradation- a natural process of nutrition cycling.Effect of preservatives on decay types micro flora

B. Practical

1. Insect collection, setting, pinning and preservation method

2. Identifying and Studying diagnostic features of wood boring insects (Coleoptera and Lepidoptera)
3. Study of damaged specimens mainly wood borers of felled and converted wood; bark and pinhole borers, beetles, sapwood borers, shot hole borers, heartwood borers and dry wood borers.
4.Termite control methods
5. Survey to Felling sites, timber depots godown to document Wood boring insects- report Submission
5.Collection of Wood boring insects and Submission of insect boxes
7.Visit to Entomology museum-Report Submission
8.Identification of different types of fungal damage in wood
9.Macroscopic and microscopic studies fungal damage in wood
10. wood Deterioration by other agents

Reference

1. Unger A, Schnienied, Unger W, (2001), ***Conservation of Wood Artifacts***, Germany: Springer Verlay Berlin Heidelberg
2. Gautam. R, (2007), ***Elements of Botany***, New Delhi: Arise publishers & distributers.
3. Sinha,R.K.,(2007),***Sustainable Development Striking a Balance between Economy and Ecology***, Jaipur,Pointer Publisher
4. Taylor,D.J.,Green,N.P.O.,Stout.G.W.,(1984) ***Biological Science***, Cambridge ,R.Soper
5. Pelczer,M.J.,Chan,E.C.S,Krieg,N.R.,(1986) ***Microbiology***, Newyork, Tata Mcgraw Hill.
6. Panshim,A.J, Zeeauw,C.D.,(1980) ,***Text Book Of Wood Technology***, U S A,Mcgraw Hill Book.
7. Schmidt,O.,(2006),***Wood And Tree Funji Biology Damage Protection And Use***, Germany, Springer-Verlag Berlin Heidelberg.
8. Goodell,B.,Nicholas,D.D.,Schultz,T.P.,(2003),***Wood Detioration And Preservation Advances In Our Chhanging World***, Washington, American Chemical Society.
9. Thompson,R.,(1991),***The Chemistry Of Wood Preservation***, Cambridge,The Royal Society Of Chemistry.

WST C 008 WOOD SEASONING

A. Theory

Objectives and importance of wood seasoning. Fundamentals of wood - water relationship.
Protection of logs, protection of green sawn timber from fungal stains, Insect attack and chemical stain. Prevention of end cracks and surface checks, stacking stickers.
Recommended moisture content of seasoned timber for different end uses in different climatic zones, and permissible tolerances. Basis of the recommendations.
Factors affecting drying rate of timber - thickness, moisture content, temperature, relative humidity and velocity of the drying air, diffusion and permeability characteristics of the species (form of moisture gradients in the timber section), sapwood and heartwood.
Seasoning defects - Surface & internal cracking, end splitting, cupping, collapse, bow, spring, crookedness etc.; their causes and prevention.
Drying stress development; measurement of drying strains. Resultant plastic strains (sets) produced.
Stress reversal and case hardening. Critical stages for surface and internal cracking; drying conditions control. Warp control · Top weighing, calculation of optimum loading (spring loading system);
Reduced crossers spacing; Drying conditions control to limit compression set and maintain core strength on stress reversal; Partial pre-air drying; SDR procedure.
Classification of Indian timbers according to refractoriness to seasoning.

Air seasoning: Stacking practice for poles, posts, railway sleepers and sawn timber. Orientation of stacks relative to wind direction. Fork lift trucks for stacking. Trolleys and transfer truck system for direct loading into kilns after partial air drying. Air seasoning sheds. FAN-AIR drying.
Kiln seasoning: General outline of kiln drying schedules. Optimum drying conditions control at different critical stages of degrade development. Kiln drying times. Modification of schedule for
higher thickness, lower initial _ moisture contents and special quality or end uses. Removal of casehardening. Reverse casehardening. Scope of accelerating a schedule.
Kiln operation: Measuring instruments of different types for temp., relative humidity and air velocity.
Selecting material for kiln samples, maintenance of steam traps.
Seasoning kilns: General design features. Heating (steam, hot water, heated mineral oil, direct/indirect heating by wood or gas-fired furnace, electricity). Steam and water spray humidification. Features of propeller and axial flow fans. Venting. Location of fans relative to timber
stack. Baffles, uniformity of air circulation & structural insulation.
Kiln design and specifications: Minimum requirements as per Indian Standard. Calculation of kiln capacity required for a given output. Possibilities of kiln automation. Boiler capacity required , kiln heat losses and energy efficiency data. Consumption of different types of fuel.
Energy in kiln drying: energy consumption in drying systems, heat transfer concepts, energy demands of various wood drying systems.
Energy conserving drying processes: Solar kilns, dehumidification kilns, vacuum drying in vapour with heat recovery, vacuum drying in RF field etc. Principles and energy savings.
Comparative economics' Air seasoning, steam heated & solar kilns.
Special seasoning methods & pretreatments: High temperature drying, press drying, chemical seasoning, presteaming, prefreezing.
Particles/Chips Dryers 2
Design, temperatures, drying time and steam consumption -Problems in sawing and seasoning and warp control in short rotation plantation timber by special sawing methods, boxing of pith & SDR procedure.
Behavior of seasoned timber in use. Movement. .IS standards in seasoning.

B. PRACTICAL

1. Practice on operating one kiln charge
2. Preparation of kiln samples
3. Calibration of instruments
4. Final moisture content of seasoned wood
5. Casehardening tests,
6. Determination of total evaporation and condensate discharge, etc.
7. Measurement of air speeds in the timber stack and computation of total air volume discharged by fans.
8. Measurement of drying strains.
9. Faults in operation & trouble shooting.
10. Classification of timbers based on refractoriness
11. Identification of seasoning defects
12. Pre-seasoning treatments
13. Collection data from the seasoning kiln and prepare the Kiln records
14. Preparation of end coating formulations and application on timber

Reference

1. Pandey. C.N, Jain. V.K, (1992), ***Wood Seasoning technology***, Dehradun: ICFRE
2. Maltcheck,C.,Kubler,H.,(1997),***Wood- The Internal Optimization of Trees***, New York, Springer-Verlag Berlin Heidelberg
3. Panshim,A.J, Zeeauw,C.D.,(1980) ,***Text Book Of Wood Technology***, U S A, Mcgraw Hill Book.

WST C 009 ADHESIVES FOR WOOD PANEL PRODUCTS

A. Theory

Elements of polymerization- step growth and chain growth polymerization-molecular weight and molecular weight distribution of polymers.
Fundamentals of adhesion- intermolecular forces—cohesion and adhesion-contact angle- Zisman's relation-critical surface tension- Thermodynamic work of adhesion.
Theories of adhesion-mechanical interlocking theory , diffusion theory,electronic theory, adsorption and specific adhesion theory - covalent chemical bonding theory.Practicallyachievable adhesive strength. Stresses in glued joints.
Rheology of adhesives — Basics of flow; determination of viscosity of adhesives- Ostwald viscometer; plate and cone viscometer; Brookfield viscometer;BubbIe viscometer
Sol-gel transformation. Wood adhesion- Influence of wood related factors on adhesion.
Natural adhesives and synthetic resin adhesives- thermoplastic and thermosetting adhesives- transformation of liquid adhesives into solids- solvent evaporation, cooling , cross-linking.
Principles involved in the preparation and curing of:
Phenol-formaldehyde adhesives; Resoles and novolacs; A-,B- and C- Stages; substituted phenol-formaldehyde resins- resorcinol-formaldehyde adhesive; Amino resins- urea-
Formal dehyde adhesive; melamine -formaldehyde adhesives; epoxy resins polyamine and tertiary amine hardeners; polyurethanes.PoIyvinyI acetate glues and applications- Electrical grade phenolic resins
CNSL-Phenol-formaldehyde adhesives- Tannin based adhesives. Hot melt adhesives -raw materials-manufacture. Fillers and extenders for UF and PF.
Phenolic and amino resins in other areas of applications.Testing of adhesion bonds.

Practical

1. To study the formulations for the production of phenol-formaldehyde and discuss the chemistry of reactions involved and the role of each ingredient in the formulation. To submit a report.
2. Submit a report discussing (with appropriate chemical equations) the formation of multifunctional monomers and the oligomers formed by the reaction of phenol with formaldehyde under the conditions employed in the 1 ton resin plant.
3. To Follow the exothermicity of the reaction and the manner the exotherm is controlled. Interpret the method adopted for the control. Submit a report discussing the themochemistry of the reaction .
4. To determine the viscosity of the resin by Ford Cup at different times and to pilot the graph of viscosity versus time.
5. To determine the water tolerance of the product at different intervals of time and to pilot the results and explain the observation.
6. To determine the solid content of the resin and to discuss the results on the basis of sol-gel transformation.
7. To make 3 ply plywood in the production Line using the phenolic resin produced above and test for BWR grade plywood.
8. To prepare UF resin in the laboratory or pilot plant.
9. To determine the solid content of UF produced.
10. To prepare a hardener suitable for the heat curing the above resin. Explain the reactions involved. Determine the pot life of the mixed resin.
11. To prepare a fortified UF resin, make plywood in the factory and test for WWR grade.
12. To prepare a UF resin mix with extender and carry out the mycological test.
13. To prepare PF resin in the laboratory, make plywood and test for BWR grade.
14. Preparation of resorcinol-formaldehyde adhesive in pilot plant.

Reference

1. Unger A, Schnienied, Unger W, (2001), ***Conservation of Wood Artifacts***, Germany: Springer Verlay Berlin Heidelberg
2. Rowell,R.M.,(2005),Hand ***Book Of Wood Chemistry And Composites***, Newyork, Taylor And Francis Group.
3. Kollmann,F.P.,Kuenzi,E.W.,Stamn,A.J.,(1975***) Principles Of Wood Science Volume 2 Wood Based Materials***, Newyork,Springer-Verlag Berlin Heidelberg.
4. Hon,D.N.S.,(1996), ***Chemical Modification Of Lignocellulosic Materials***, Hongkong, Marcel Dekker,Inc..
5. Goodell,B.,Nicholas,D.D.,Schultz,T.P.,(2003),***Wood Detioration And Preservation Advances In Our Chhanging World***, Washinton, American Chemical Society.

WST C 010 MANAGEMENT PRINCIPLES

Objective: To acquaint the students with the management principles and their implication on modern industry and business. It also aims at imparting various managerial skills to tackle the problems of an organization In an effective manner.

THEORY

Meeting and definitions of Management-Historical development-Approaches to Management- *Processes and functions* of management-Social responsibilities of management.

School of Management thoughts-Classical theory-Neoclassical theory—Systems Theory- Contingency theory-Planning and Decision making—Objectives-concept And Principles—Techniques-Processes

Type of plans-Implementation of plans-MBO

Organizing-Nature-Purpose-Principles-Line, Staff and Lateral relations-Departmentation

Delegation Centralization & Decentralization-Level of authority-Span of control. Traditional and modern organizational structures

Staffing: Selection and Recruitment—Performance appraisal—Training and Development-Directing and leading-Basic concepts and techniques. Motivation-Leadership processes and approaches

Communication-Importance-Types Barriers to effective communication-Techniques to overcome barriers of communication-Control and Coordination-Concepts-Elements-Processes and Techniques.

References

1. S. Toner. J.A.F., Freeman R E., Gilbert Jr. D R., (2008), ***Management*** , New Delhi, PHI Learning Private Limited.
2. Koontz H., Weihrich H., (2008), **Essentials *of management an international perspective***, New Delhi, The McGraw Hill Companies

WST E 011 FUNCTIONAL MANAGEMENT

Objective: The objective of this course is to give the students a brief overview of the three major functional areas of management i.e. Financial Management, Marketing Management and Human Resources Management-Financial Management

Nature and Scope of financial management.

Investment decisions: Capital budgeting process-Appraisal methods.

Financing decisions: Sources of finance Debt, Preference and Equity capitals

Working capital policy-Importance of working capital management

Inventory management: importance of management of inventory

Cash management: Importance factors affecting cash baIance·Cash budgeting Marketing Management

Marketing concept—nature—Scope and importance—Marketing mix

Buyer behavior-Major factors influencing buyer behavior _ Product decisions-Classification of products—Product In and product mix Branding, Packaging and
Labeling-Pricing and promotion decisions-Factors to be considered in pricing and promotion strategies
Advertising-Personnel selling-Sales promotion-publicity and public relations.
Distribution channels and physical distribution decisions
Human Resources Management Introduction to Human Resources Management-Nature and Scope of Human Resources Management-
Personnel Department-Structure and functions Human Resources Procurement (HPR)-Manpower planning-job Analysis- Recruitment-Selection-
Induction—Placement-Promotion and Transfer-Human Resources Development (HRD)-Training and Development-Assessment of training needs and
training methodologies-Evaluation of training scheme-performance appraisal

Reference

1. Kumar. A, Meenakshi. N, (2006), ***Marketing Management***, New Delhi: Vikas Publishing House Pvt. Ltd.
2. Arch.D (1998), ***All new tricks for trainers***, New Delhi: Ane books
3. Kotler. P, Keller. K.L, Koshy. A, Jha.M, (2009), ***Marketing management a South Asian Perspective***, New Delhi: Dorling Kindersley Pvt Ltd.
4. Chandan, J.S.,(1987), ***Management Theory And Practise***, NewDelhi, Vikas Publishing.
5. Paul,S,Kr.,(2005), ***Financial Management***, Kolkkatta, Central.

WST E 012 ENVIRONMENT, ECOLOGY AND GLOBAL WARMING RELATED TO WOOD INDUSTRY

Objective: The objective of this course is to acquaint the students on the current importance of the environment and global warming and the role the wood products plays in reducing the global warming. Syllabus also includes the issues related to the utilization of wood wastes and residues leading to complete utilization of trees and conversion of wastes into assets.

Basic concept of ecology- energy flow in ecosystem- study of Autecology and synecology- plant association and society. Ecosystem- components in ecosystem and biotic inter—relationship- population development and population interaction-plant succession- climax community- theories and application.

Vegetational study- community characters- life and structural description- Ecotone- species diversity index. Ecological productivity- Efficiency of ecological production- Ecological energetics- source of energy. Biomass production- forest productivity and carbon budgeting in ecosystem.

Leaf litter fal decomposition- humus formation- microbial decomposition. Nutrient cycle- C, Oz, SO2, N2, P, S, Cycle in ecosystem.

Global warming - general aspects- wood products and their global warming reduction potential

Wood and agro wastes. Wood residues - type's .Their impact on environment- wood residue utilization for energy. Ugradation of wood residues. Scientific principles involved in composting and vermiicomposting. Energy from wood- briquetting· wood gasification- production of bio-ethanol from lignocellulosics.

Emission problems of formaldehyde from wood products. Emission of Volatile Organic Compounds (VOC) from chemicals employed in wood adhesives and surface coatings- Emission of ozone in the atmosphere. Depletion of ozone in environment. Acid rain. Radiation ecology- effect on radiation on environment.

Reference

1. Santra,S.C.,(2001),**Environmental Science**, Kolkata,New Central Book Agency (p)Ltd.
2. Elliott, David, (2002), **Energy, Society and Environment** , Routledge

WST C 013 WOOD PRESERVATION

A. Theory

Nature and conditions of attack by various wood-bio degrading organisms on land. Estimates of losses of wood by biodegradation in storage, processing and service. Importance of wood preservation.

Natural durability, durability of heartwood and sapwood. Causes for natural durability. Classification of timbers on the basis of natural durability.

Methods of determination of natural durability Including accelerated methods. Testing of the efficacy of preservatives under laboratory and field conditions including marine.

Preservatives/preservative materials toxic to various biodegrading agents - their toxicity levels. Bio-degradable preservatives. Preservation under marine conditions.

Requirement of an ideal preservative. Types of wood preservatives. Merits/de—merits of different preservative compositions in relation to end use.

Recommended preservatives and their retention and penetration for various end uses.

Non pressure treatment processes: brushing, spraying, dipping, steeping, cold soaking, hot and cold bath, sap displacement & diffusion methods. Their efficacy and suitability for selected end uses.

Pressure processes: full cell, Rueping (empty cell) & Lowry treatments. Special oscillatory pressure treatment for green timber with water soluble preservatives.

Miscellaneous processes: prophylactic treatment, Boucherie treatment and Osmosis treatment for green timber. Treatments for bamboo and thatch. Remedial treatments for installed timber.

Qualitative and quantitative analysis of preservatives in their free condition and in the treated timber.

Dependence of penetration and retention of preservatives on wood structure and permeability.

Preparation of timber for treatment. Treatability classification of timbers. Penetration indices. Present voids filled. Pretreatment techniques for refractory species. Post treatment measures.

Preservative treatment plants, design, specifications, layout, operation, inspection, maintenance and economic aspects. Environmental health and safety measures.

Economics of preservative treatment. IS specifications governing preservatives.

Fire protection of timber. General principles of combustibility, application of fire retardant chemicals, methods of testing fire resistance.

Chemical modification of lignocellulosic material to impart dimensional stability and bio resistance.

New generation, eco·friendly preservatives.

B. Practical

Chemical analysis of preservatives in free and in treated wood (Cu, Cr, As, B, Chlorinated compounds and Cu resinates).

Spot tests for determination of penetration.

Tests for fire retardancy.

Treatment of timbers of different treatability classes with representative preservatives and evaluation of treatment parameters (time, temp., and pressure).

Boucherie sap displacement. Hot and cold bath and diffusion treatment.

Calculation of voids for estimating maximum absorption.

Determination of penetration indices.

Treatment of problematic refractory heartwood like eucalyptus.

Examination of test specimens in timber yards and demonstration of accelerated test method against termites.

Reference

1. Unger A, Schnienied, Unger W, (2001), ***Conservation of Wood Artifacts***, Germany: Springer Verlay Berlin Heidelberg

2. Thompson,R.,(1991),***The Chemistry Of Wood Preservation***, Cambridge, The Royal Society Of Chemistry.
3. Townsend, T.G., Solo-gabriele,H.,(2006),***Environmental Impacts of Treated Wood***, New York, Taylor & Francis

WST C 014 VENEER, PLYWOOD AND COMPOSITES

A. THEORY

Introduction- veneer- Definition Pretreatment of logs prior to peeling and slicing-protection against decay and checking- scanning for embedded metals-steaming,boiIing, cooking of round logs-
debarking and cleaning- veneer slicing- veneer rotary peeling-
Lathes Telescopic spindle lathes- Lathes for small diameter logs- Optimum conditions of setting of peeling lathe- Defects in peeled veneers-veneer handling from slicer or peeling lathe-trimming and clipping.
Veneer drying- types of veneer dryers- relative merits-physics of veneer drying shrinkage in drying · collapse-warp and their control··recommended drying times- temperature-jet air speeds- and venting-
Steam consumption.
Veneer jointing splicing-- adhesive applications- glue spreaders - assembly time- hot pressing-m hydraulic multiday light presses-
Plywood- Principles of manufacture, composition with regard to veneer thicknesses and species.Glue spreaders. Optimum glue spreads. Pr-pressing- Advantages of pre-pressing Storage before pre- pressing/hot pressing. Assembly, Hot pressing — Hot Press design parameters recommended pressing
time -sizing, trimming, thicknessing and finishing. Compression in hot pressing. Defects in pressed plywood, their control and repair.
Properties of plywood- elasticity and rigidity—tensile strength compressive strength—bending strength-shear strength- hardness- Resistance against destruction.
Laminated wood
Definitions
Choice and Quality of sawn timber for Laminated wood. Finger jointing. Choice of glues. Gluing and assembly. Arrangements for cold pressing and curing. RF gluing. Principles. Block shear test for
bonding strength and tensile test for finger joint strength. . Applications.
Laminated Veneer Lumber(LVL)
Structural Lumber. Glued laminated products and their applications as structural composites
General information on production and properties of reconstituted wood with unidirectional orientation of grain from de-structured bamboo, small wood, reeds etc. Properties and comparison with natural solid wood. Applications.
Sandwich Composites- facings cores-adhesives-sandwich assembly —test methods.
Flush doors-block boards—manufacture- properties and applications.
Compreg- definition- production ,properties and applications in mechanicaI,eIectrica,chemicaI and transportation industries-Reduction of global warming potential of wood products.

B. PRACTICAL

A. In the plywood production plant `
1. To study of logs in storage in log ponds- examine any marine borers, inseam, or other organisms and try to identify the same.
2. To study of the boiling logs-determine the time needed for boiling
3. Veneer lathe adjustments for smooth veneers of uniform thickness
4. Drying of veneers - determination of time of drying for different thicknesses, species and initial moisture content.
5. Adjustment of venting - steam consumption· V
6. To study of veneer assembly for balanced construction

7. Calculation of specific pressure of pressing during hot pressing

B. Laboratory Experiments A

1. To prepare samples for determining the glue hear strength of plywood
2. Calibration of Universal Testing Machine
3. Determination of glue-shear strength of different grades of plywood
4. Accelerated tests for plywood for glue adhesion
5. Tensile strength of plywood
6. Bending strength of plywood
7. MOE of plywood
8. Production of compreg
    i. Veneer selection
    ii impregnation of veneers
    iii Drying of veneers
    iv Hot pressing
    v Machining to different products

Reference

1. Bull,J.W.,(1989),***The Practical Design of Structural Elements in Timber***, U.S.A, Gower
2. Ozelton,E.C.,Baird,J.A.,(1976), ***Timber Designs Manual*** ,Germany, Blackwell publishing.
3. Kollmann,F.P.,Kuenzi,E.W.,Stamn,A.J.,(1975***) Principles Of Wood Science Volume 2 Wood Based Materials***, Newyork, Springer-Verlag Berlin Heidelberg.

WST C 015 RECONSTITUTED WOOD PANELS

A. Theory

Particleboard - Definition· Types - Raw materials- wood and other lignocellulosic materials-adhesives-additives-

General technology-particle preparation-drying- of chips- size separation and storage of chips—chip blending —mat lay up- pre-pressing- hot pressing- multiday light presses—extruded particle boards Properties of particleboards-factors affecting the properties··density-moisture content-modulus of elasticity-modulus of rupture-internal bond strength in dry state and after accelerated aging Test methods- End uses

Fiberboards- definition- types- raw materials and their preparation- wet and dry process-pulping- chemical and mechanical pulping-thermo—mechanical pulping- Asplunds defibrator method- wet process of manufacture of hardboard-mat formation-hot pressing -press cycles. Oil tempering. Dry process of hardboard.

MDF· Raw materials-wood & lingo-cellulosic agricultural residues. Chipping. Methods of open yard storage. Pulping/defibrizing procedures. Residual Lignin content in pulp or fiber mass. Drying of pulp or fiber mass, incorporation of resin and preservative during drying of the fiber mass for MDF.Hot pressing for MDF.Continuous presses.lnsulation boards. Tempering of hardboard. Resins for exterior and interior grade MDF.

Properties of hardboard & MDF. Testing methods and end uses

Wood residues and their up gradation for use as compost and vermicompost. Economic and ecological impacts.

Concept of global warming reduction potential of wood based products- introduction to global warming comparison of wood products with other materials such as steel, concrete ,bricks etc.

Glued laminated products and their applications as structural composites.

B. Practical:

A. At the production plant ,the students will visit the designated locations in the hardboard plant of WIP and make an in depth study of the operations, processes, functions of machines and submit reports on their observations, inferences and scientific interpretations. These reports will be assessed in CA, and the final Comprehensive viva voce.

1. To study the raw materials-storage; to collect samples for identifying insects and other organisms.

2. Raw Material Preparations
(a) To study the debarking, chipping
(b) Chipping and screening
(c) Storing
(d) Chip washing

3. Pulping-Asplunds defibrator and refiner '
4. Mixing chest wax emulsion preparation-addition of additives
5. Fourdrinier machine -·mat formation
6. Hot pressing
7. Oil tempering
8. Trimming and additional processing

B. Laboratory experiments
1. Freeness of hardboard pulp
2, MOR of standard and oil tempered hardboard
3. Water absorption and thickness swelling of hardboard and commercial particleboard
4. Tensile strength of hardboard and commercial particleboard board
5. Specific gravity of hardboard and commercial particleboard
6. Modulus of elasticity of hardboard
7. Impact strength of hardboard
8. Screw holding capacity of hardboard and commercial fiber board

9. Solid Waste Disposal and residue up gradation
(a) Pretreatments
i. Characterization of wood wastes such as pH,porosity, and electrical conductivity
ii. Pre—treatment by steaming
iii. Pretreatment of wood wastes by microbial consortium and carrying out the characterization
iv. Pre—treatment of wood wastes by fungi and characterization.
b) Composting and vermicomposting of the pre-treated wastes and
characterization of the composts

10. Compressed pulp boards the production unit
    i. Raw materials
    ii. Pulp dispersion- principles
    iii. Characterization
    iv. Consolidation- principles, plasticization and compression.
    v. Drying -principles ,drying conditions, drying time

Reference

1. Hakkila.P, (1989), ***Utilization of residual forest biomass***, Germany: Springer Verlay Berlin Heidelberg
2. Kollmann,F.P.,Kuenzi,E.W.,Stamn,A.J.,(1975***) Principles Of Wood Science Volume 2 Wood Based Materials***, Newyork,Springer-Verlag Berlin Heidelberg.

WST C 016 WOOD MECHANICS & TIMBER GRADING

A. Theory

Basic important physical and mechanical properties.
Hooke's law, modulus of elasticity, anisotropy, various elastic constants in wood. Poisson's ratio. Compressibility (Bulk modulus) determination of elastic constants by dynamic and static tests. Non- linear behavior of wood. Hysteresis.

Creep deformation, plasticity and creep recovery. Theory of creep. Effects of level of loading, moisture content, temperature, dynamic humidity conditions and pre-freezing on creep. Creep in reconstituted wood panels.

Fatigue and its characteristics. Defects in wood, their identification, measurement and evaluation with regard to strength degrade.

Timber grading principles and importance of quality of logs and sawn timber. Visual and machine grading of converted timber. Grading rules prevailing in various states, IS specification on grading of logs converted into timber and other items.Wood Mechanics & Timber Grading

Mechanics of wood columns and beams.

Standard tests on timber specimen; static bending, impact bending, compression parallel & perpendicular to grain, hardness, shear, tension perpendicular and parallel to grain, cleavage, torsion, nail and screw pulling, brittleness tests, effects of specimen size and its standardization. Effect of speed of loading. Determination of safe working stresses for use in design of structures.

Testing of specialized finished wood products — different types of performance test and methods of evaluation for products like door shutters, joinery, furniture, packing cases, tool handles agricultural implements and sports goods. Determination of suitability coefficients and indices of Indian timbers,

Classification of timbers for different end uses based on suitability indices and safe working stresses.

Non-destructive testing methods for timber strength.

B. Practical

1. Mechanical tests on timber
2. Static bending
3. Impact bending
4. Compression parallel to grain
5. Compression perpendicular to grain
6. Hardness test
7. Shear test
8. Torsion
9. Nail and screw pulling test
10. Brittleness test
11. Tension parallel to grain
12. Tension perpendicular to grain

Reference

1. Faherty, Keith F., (1998) and Thomas G. Williamson. ***Wood Engineering and Construction Handbook***. 3rd ed. New York: McGraw-Hill,
2. Kollmann,F.P.,Kuenzi,E.W.,Stamn,A.J.,(1975***) Principles Of Wood Science Volume 2 Wood Based Materials***, Newyork,Springer-Verlag Berlin Heidelberg.

WST E 017 PRODUCTION MANAGEMENT

Objective: The course id designed to acquaint the students with decision making in planning scheduling and control of production and operation function both manufacturing and service.

Course Outline:

1.Production as an organization function-Importance of production function- Scope of production and operations management- Characteristics of modern production and operation function.

2.Production processes, manufacturing and service operations classification of manufacturing processes-product design and process design.

3.Plant location and layout—nature-Location theories-Steps in location-Location models-Plant |layout—Factors influencing lay out—Principles of lay out-Layout tools and techniques- Materials handling principles.

4. Production /Operations planning & Control- Factors determining production planning- Production planning system-Production control- Elements of production control- Factors determining production control-Objectives of production planning and control.
5. Quality control-Organization for quality control- Quality control techniques-Statistical quality control-Types of control charts- Total Quality Management
6. Plant maintenance - Meaning and definition- Scope- Importance- Objectives of Plant maintenance management- Models for maintenance management- Implementation of maintenance management

Reference

1. Kalavanthy,S.,(2002), ***Operation Research***, New Delhi, Vikas Publishing.

WST E 018 ADVANCED COATINGS FOR WOOD AND OTHER SUBSTRATES

Coatings definition- Composition of coatings- Film forming resins/binders. Binders based on amino resins-Melamine formaldehyde resins (MF) - reactions of Urea-formaldehyde resins in coatings- MF resins in coatings-reactions with urethanes- and alkyds.
Drying oils- composition of natural oils- drying ,semi-drying and non-drying oils. Autoxidation and cross-Linking- non-conjugated and conjugated drying oils. Modification of drying oils-maleated oils-Vinyl modified oils.
Alkyd resins-Oxidizing alkyds and non oxidizing alkyds-Alkyd resins production-water reducible alkyds-Uralkyds-Epoxy esters.
Binders based on Isocyanates and Polyurethanes (PU) -reactions of isocyanates- non-catalyzed reactions and catalyzed reactions lsocyantes used in coatings-Aromatic and aliphatic isocyanates-
Coatings formulations and chemistry of curing.
PU dispersions.
Epoxy and Phenolic resins-acrylic resins thermoplastic and thermosetting acrylics.
Film formation characterization of resins- film formation by solvent evaporation, by cooling ,by chemical reaction- -rheology and visco elasticity - flow-viscosity and its determination
Solvents- solubility parameters-solvent evaporation rates-Atmospheric photochemical effects. Pigment dispersion Pigment volume relationship.
Application methods- Brushes- Spray applications- dip coating-Roller coatings- precision roller and reverse roll coatings- Curtain coatings.
Film defects—surface tension-leveling—Sagging-crawling ,crawling-Wrinkling·.
Environmental impact of coatings Environmentally friendly coatings: High solids coatings, Radiation curable coatings- Powder coatings.
Nanotechnology-inorganic-organic hybrid materials —sol-gel route —scratch resistant coatings.
Film defects.
Mechanical properties-abrasion and mar resistance- Measurement of mechanical properties.
Tests on coatings- hardness-formability-impact resistance- abrasion resistance-solvent resistance.
Gloss and the measurements. Exterior durability.
Wood coatings-NC Lacquers- acid curing type, UV curable coatings formulations Problems involved in the coating of wood

Reference

1. Bhat,S.V.,Nagasampagi,B.A.,Sivakumar,M.,(2005), ***Chemistry of Natural Product***, Mumbai, Narosa
2. Solomons,T.W.G,Feyhle,C.B.,(2004)***Organic Chemistry***, Singapore,Willey.
3. Zoril,U.,(2001),***Polyurethanes for Coatings,*** Germany, Vincentz Verlag Hannover.

WST C 019 INDUSTRIAL PLACEMENT AND REPORT SUBMISSION

(1 month Including journey time)

Each student will be placed in a suitable wood based industry where he will be required to complete practical work on an Industry Project to be assigned in consultation with that Industry. A report on the results shall be submitted by him for evaluation at the end of placement.

WST C 020 PULP AND PAPER

A. Theory

Introduction: Raw materials - classification- selection- sources—storage- debarking- chipping- screening of chips- types of screens- chip classification- analysis- conveying of chips- chip storage.

Pulping processes: Types- principles and details of processes- properties of pulp- cooking processes.

Washing and screening of pulp: principles of washing- types of washers - presses- screening and cleaning of pulp- types of cleaners and screeners.

Bleaching of pulp: Principles of bleaching- bleaching chemicals- stages of bleaching important parameters of bleaching- bleaching equipments- preparation of bleaching chemicals.

Chemical recovery: Black liquor-properties- evaporation: working principles, types — boiler and furnace: types, function- efficiency and steam economy, boiler feed water properties.

Causticizing: Functions, batch and continuous processes, green liquor classification and sludge removal- white liquor, classifiers and washers, operating techniques, make up chemicals, Zeolite process, demineralization process.

Effluent treatment: Physical and chemical nature of effluents and their treatment- pollution control and norms, chemicals used in effluent treatment- air pollution and control.

History of paper; Pre- treatment for paper making:

Stock preparation ; Loading of fillers : types, properties and efficiencies of fillers, effect on paper properties Sizing : types of sizing, materials used, mechanism of sizing, effect of paper properties ;

Additives: types, wet strength resins and their effect on strength properties, flocculants, biocides and their effects, synthetic fibers, improvement of dry strength by synthetic polymers ; Color and Pigments: dyes, optical whiteners, types and properties, effect on paper, shade matching, color mechanism, retention aids.

Paper making:

Introduction to paper making, overview of paper machines, dry and wet ends, stock and water systems, related machinery ; Wet end colloid chemistry, retention performances ; Deposit control in paper making : problems and control; Basic Lab measurements : experimental methods, liquid –mass balance, paper machine operation ; Fourdrinier paper making ; Twin and multiple paper making. Pressing : types of presses, pressing operation variables ; Drying : theory, systems, plant and equipment ; Surface sizing : characteristics of materials used, surface preparation, sizing application, properties of sized papers ; Coating : types and properties, types of coating machines and principles of operation ; Calendaring and Super Calendaring : types of machines used, principles of operation and control, properties and applications of coated papers.

PRACTICAL (TENTATIVE)

1. Bleaching of mechanical pulps
2. Determination of Kappa number of pulp
3. Analysis of pentosan in pulp
4. Analysis of CED Intrinsic viscosity of pulp
5. Determination of Drainability of pulp
6. Grammage of Paper and Paper Board

7. Thickness of Paper and Paper Board
8. Tensile Strength of Paper and Board
9. Determination of Bursting Strength of Paper.

Reference

1. Williams. P.A, Philips. G.O Kennedy.J.F, (2000***), Cellulosic pulps, fiber & Materials***, England: Wood Head publishing Ltd.
2. Biermann,C.J.,(1996),***Hand Book of Pulping and Paper Making***, New Delhi, Academic Press.
3. Britt,K.W.,(1984),***Hand Book Of Pulp And Paper Technology***, New Delhi, CBS Publishers & Distributors.
4. Kennedy,J.F.,Philips,G.O.,Williams,P.A.,(1996)***The Chemistry And Processing Of Wood And Plant Fibrous Materials***,England,Wood Head Publishing Ltd.
5. Bajpai,P.K.,Kondo,R.,(1999),***Biotechnology for Environmental Protection in The Pulp and Paper Industry***, New York, Springer-Verlag Berlin Heidelberg
6. Borch,J.,Mark,R.E.,Brucelyne,M.,(2002),***Hand Book of Physical Testing of Paper***, NewYork, Marcel Dekker,inc.
7. Rowell,R.M.,Young,R.A.,(1996),***Paper and Composites From Agro-Based Resources***, London, Lewis publishers.
8. Sjostrom,E.,(1993),***Wood Chemistry Fundamentals and Application***, New York, Academic press,inc.

WST C 021 SAW MILLING AND SAW DOCTORING

A. Theory

Management of timber log yard.

Layout comprising space of logs unloading, log stacks, movement of mechanical log loaders/stacker and transport of logs to sawmill. Choice of suitable loader/stacker. Alternative manual loading/unloading arrangements under Indian conditions.

Measures for yard hygiene,. Spraying of prophylactic preservatives and end coating of logs for protection against bio—degradation and end splitting.

Hoppus Si true volume measurements of logs.

Sawmilling: Saw milling equipment, their capacities and specifications - Log chain saws, Horizontal band mill, Vertical band saw benches, Circular re-saws, Circular cross cut saws, Log scanners and computerized BOF system, Gantry equipment for loading/unloading of logs on machines.

Economic conversion of logs; parameters & decision making.

Saw doctoring : Saw blade geometry & maintenance: Clearance, sharpness & hook angles, Pitch,

Gullet capacity, peripheral/linear saw speed, Feed speed, Bite etc.

Quality & choice of metal in saw blades. Tensioning, leveling, straightening, brazing, setting and tempering of saw blades. Automatic/Semi-automatic saw doctoring equipment.

Air drying & storage sheds of converted timber

Layout of trolley lines relative to seasoning kilns. Transfer truck system.

Modern Developments

Degree of automation and mechanical feeds available in indigenous and imported saw mill equipment.

Modern innovations including quality and geometry of saw blades, speeds and performance comparison.

Appropriateness-selections of machines for Indian conditions and production norms.

Sewing equipment for small—girth logs.

Saw mill Layout carriage and track ways; layout of machines.

Saw tipping.

B. PRACTICAL

Operation & maintenance of various sawmilling machines.
Measurement of yield of converted timber and defects for a representative log based on Hoppus and true log volume measures.
Saw doctoring practice for band & circular saws.
Brazing, tensioning Bi setting of band saw.

Reference

1. Feirer,L.J.,(1994) ***Wood Technology and Process***, New York: McGraw Hills.
2. Pandey C.N.,(2008) **Saw Milling And Saw Doctoring**., IPIRTI,Banglore.

WST E 022 WOOD WORKING & WOOD FINISHING

A. Theory

Introduction to various wood working operations; planning, thicknessing, mortising, tenoning, rebating, grooving, molding and shaping, turning, drilling, carving, sanding etc. Tool/knife movement relative to the grain direction in different operations. Essential principles of operation.
Various working defects; their occurrence in Indian Woods; and remedies. Moisture related problems in wood working.
Working qualities of Indian timbers; method of assessment-ease of working based on energy consumption and assignment of quality ratings for important basics operations; computation of composite working quality index for the species. Wood carving properties.
General features, specifications and design of machines; planer, thicknesser, mortiser, tenoner, molders, router, turning lathe, drill, etc. Cutting speed of cutter,/tool, feed sped, feed mechanism of each machine. Advanced woodworking machines such as 4—side combination planer/moulder, router/CNC router, copying lathes, dowel making, dove-tailing machine, doubIe—end tenoner, oscillatory 3—drum sander, portable sander and planer, muIti—spindle boring machine etc.
Elements of basic joinery. Wood working joints. Furniture designs. Knock—down and ready to assemble panel furniture. Bent-wood furniture. Dowel joints. Glues recommended for furniture and joinery. Ergonomic considerations in furniture design.
Knife geometry. Automatic knife sharpening machine. Tungsten carbide tipped cutters.
Figure in wood occasioned by growth increments, nature of woody tissues, radial or tangential cut, grain, uneven infiltration of coloring material etc. Finishing qualities of Indian woods. Indices of finish adaptability. Tests for surface smoothness and gloss.
Filling, staining and sanding before application of surface coatings. Compositions used. Water based, spirit, oil & NGR, pigment oil and chemical stains. Opaque and clear finishes. Penetrating and non- film forming finishes. Figure and color upgrading by ammonia fumigation and use of natural dyes.

B. Practical

Practice on the different wood working and finishing operations on two common timber and one refractory timber such as eucalyptus. Testing of surface smoothness and gloss .Ammonia fumigation of eucalyptus wood. Demonstration of testing procedures for moisture excluding efficiency and weathering.

Reference

1. Nirka. O.K., Sain.M., (2008), ***Wood Polymer composites***, England: Wood Head Publishing Ltd.
2. Feirer,L.J.,(1994) ***Wood Technology and Process***, New York: McGraw Hills.
3. Smith, I.,LANDIS E ,Gong m.,(2003),***Fracture and fatigue in wood***, England, Wiley.

4. Sentence, B.,(2003), ***Wood The World Of Wood Working and carving***, London, Thames and Hudson.
5. Newmann,M.,(1995), ***Design And Construction Of Wood Framed Buildings***, Washington, D.C, Mcgraw Hill, Inc.
6. Feirer,J.L.,(1994), ***Wood Technology And Processes***, Glencoel Mcraw-Hill.

WST E 023 TIMBER ENGINEERING & CONSTRUCTION

Scope and significance of modern timber engineering in India in relation to concrete, steel and plastics as construction materials, new development, economy, building code and its application.
Strength properties and design of structural timber joints, conventional vs new types - Fasteners, strength in single, double and multiple shear. Design of timber joints with nails, bolts, wooden disc dowels, dowel pins, steel ring connectors and adhesives with side members of timber, plywood & MS plates, Scarf, finger and glued lap jointing for load and non-load bearing applications. -
Design of linear structural components: Beams, Ties, Purlins, Columns, Joists .
Trusses & arches—Configuration, analysis of simply supported 2 hinged , 3 - hinged types.
Design of special structures; timber Lamellas' & timber flooring.
Web type girder, composite construction, stressed skin construction, rigid frames, shells, transmission line towers etc.
Glue laminated linear and curved structural members, shear strength, analysis and design.
Finger jointing of short length timber for use in door frames & stiles
Prefabrication: merits/demerits, techniques, design of low cost structures.
Destructive proof testing of timber structures. Wood and bamboo in earthquake resistant construction.

Reference

1. Williamson,T.G.,(2002), ***APA Engineered Wood Hand Book***, New York. McGraw-Hill.
2. Thelandersson,S., Larsen,H.J., (2003),***Timber Engineering***, Sweeden, J ohn Willey and Son Ltd.

WST C 024 DISSERTATION AND COMPREHENSIVE VIVA VOCE

Dissertation on any one important project of study in Wood Seasoning/Wood Preservation/Wood based Panels/ Wood Mechanics & Grading/Timber Engineering and Construction/Wood Working and Finishing/ Wood Physics/Wood Structure. Each student will carry out library consultation, consultation with assigned guide and prepare Synopsis prior to embarking on project work and will prepare a report on the results and will be required to present it in a Seminar. In addition comprehensive viva will be conducted.

WST O 025 FORESTRY AND FOREST PRODUCTS - THE ECOLOGICAL PERSPECTIVES

Forest wealth in the world – forest in relation to that of the world- contribution of forestry sector to GDP. Important roles of forests –productive role and bioaesthetic role . Forest and environment -Forest type; Tropical, sub-tropical, temperate, deciduous, evergreen forests, rain forests. Forestry policies –agro-forestry, ecological and economic importance-Forest conservation problems and prospects. Extension activities in forest conservation. People's participation in forest conservation and management.

Competing and challenging needs of both the forestry sector and forest products industry. Global concerns and changing societal needs.

Carbon Sequestration in Forestry-how forestry practices sequester carbon and reduce greenhouse gases-climate change, biodiversity, forest ecology, forest plantations, applied biotechnology in forestry, green technology, eco-tourism, socio-economic aspects of forestry and forest products industries , medicinal products from plant material, improved processing, and utilization of wood and non-wood products- wood panel products industry and its impact on environment and societal impact.

Protecting forest products to retain sequestered carbon for long duration- -Effects of biodegrading organisms i.e.; fungi, insects, termites etc on forest and forest products .

Basic concept of energy requirements in the production of materials -.comparison of energy requirements of wood, metals, concrete and others and the impact of the same .Global warming. The superiority of wood products in this respect General aspects, wood products and their global warming reduction potential. Wood and agro wastes, wood residues types, and their impact on environment, wood residue utilization. Role of bio fertilizers in ecology

Reference

1. Sinha. R. K, (2007), ***Sustainable development striking a balance between economy and ecology***, Jaipur: Pointer Publishers.
2. Young,R.A., Giese,R.L.,(2003), ***Introduction To Forest Ecosystem Science And Management***, United States Of America, Willey.