List of Reports and Publications on
THE USE OF WOOD IN AIRCRAFT
CONSTRUCTION
November 1946

UNITED STATES DEPARTMENT OF AGRICULTURE
FOREST SERVICE
FOREST PRODUCTS LABORATORY
Madison, Wisconsin
In Cooperation with the University of Wisconsin
TABLE OF CONTENTS

This list, which begins on page 3, includes publications that give general information and the results of research on the strength, selection and character of aircraft wood and plywood; fabrication and assembly problems, methods of calculating the strength of wood parts; and the structure of wood in relation to its properties and identification.

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INSTRUCTIONS FOR OBTAINING PUBLICATIONS

Publications available for distribution at this Laboratory are marked with an asterisk (*).

Single technical notes, reprints, and mimeographed reports may be obtained free upon request from the Director, Forest Products Laboratory, Madison 5, Wisconsin. A bound volume of the technical notes only, containing the notes listed here and notes dealing with other subjects, in all more than 100 notes, may be purchased for $1. (This volume does not include the reprints and processed reports mentioned in the list.) Remittance should accompany your order in the form of certified check or postal money order, made payable to the U. S. Treasurer. If money order is used it should be made payable at Chicago, Ill.

Federal Government bulletins, circulars, and leaflets, if not available for free distribution at this Laboratory, may be purchased at the price indicated from the Superintendent of Documents, Government Printing Office, Washington 25, D. C. Send money order, draft, or cash; stamps or personal checks are not accepted.

Trade journals containing articles herein listed may be purchased from the publishers or consulted in various libraries.

The Forest Products Laboratory reserves the right to furnish only those publications which in its judgment will give the information requested. Blanket requests or requests for a large number of copies of any individual article will not be filled except in unusual cases.
MECHANICAL PROPERTIES

Processed Reports

48  *Notes bearing on the use of spruce in airplane construction.
1079 *Aircraft woods: Their properties, selection, and characteristics.
1300 *Summary of formulas for flat plates of plywood under uniform or concentrated loads.
1301 *Method of measuring the shearing moduli in wood.
1302 *Data on the design of plywood for aircraft.
1303 *Specific gravity-strength relations for wood.
1304 *Methods of computing the strength and stiffness of plywood strips in bending.
1305 *Effect of 5,000 cycles of repeated bending stresses on 5-ply Sitka spruce plywood.
1306 *Effect of moisture on the compressive strength of plywood and laminated wood.
1307 *Design of airplane wing ribs.
1308 *Forest Products Laboratory’s toughness testing machine.
1309 *Deflection of beams with special reference to shear deformations.
1310 *Form factors of beams subjected to transverse loading only.
1311 *Stresses in wood members subjected to combined column and beam action.
1312 *Flat plates of plywood under uniform or concentrated loads.
1313 *Moisture content-strength adjustments for wood.
1314 *Methods for determining the specific gravity of wood for airplane use.
1315 *Tentative method of calculating the strength and modulus of elasticity of plywood in compression.
1316 *Buckling of flat plywood plates in compression, shear, or combined compression and shear.

Supplements to 1316:

1316-A *Buckling of flat isotropic plates in compression, shear, or combined compression and shear.
1316-B *Buckling of plates of any symmetrical construction. Edges simply supported. Buckling of plates with two edges clamped.
1316-C *Plates having the grain of the face plies inclined to the edges.
1316-D *Buckling of flat plywood plates in compression with face grain at 0° and 90° to load.
1316-E *Effective width of thin plywood plates in compression with the face grain at 0° and 90° to load.
1316-F *Buckling of long flat plywood plates under uniform shear. Grain of face plies inclined to edges. Edges clamped.
1316-G *Buckling tests of flat plywood plates in compression with face grain at 15°, 30°, 45°, 60°, and 75° to load.
1316-H *Buckling of flat plywood plates in uniform shear with face grain at 0°, 45°, and 90°.
1316-I *Effective width of thin plywood plates at maximum load in compression with the face grain at 0°, 15°, 30°, 45°, 60°, 75°, and 90° to load.
MECHANICAL PROPERTIES (continued)

Processed Reports

1317  *The application of Mohr’s stress and strain circles to wood and plywood.
1318  *Design of plywood webs in box beams.

Supplements to 1318:
1318-A *Stiffeners in box beams and details of design.
1318-B *Buckling in shear webs of box and I-beams and the effect upon design criteria.
1318-C *Additional tests of box beams and I-beams to substantiate further the design curves for plywood webs in box beams — tests of plywood webs in the tension field.
1318-D *Buckling and ultimate strengths of shear webs of box beams having plywood face grain direction parallel or perpendicular to the axis of the beams.
1318-E *The effect of repeated buckling on the ultimate strengths of box beams with shear webs in the inelastic buckle range.

1320  *Effect of ten repetitions of stress on the bending and compressive strength of Sitka spruce and Douglas-fir.
1322  *Buckling of long, thin, plywood cylinders in axial compression.

Supplements to 1322:
1322-B *Experimental treatment.

1323  *A comparison of the buckling strength of thin-walled cylindrical and barrel-shaped plywood shells.
1324  *Plastic flow (creep) properties of two yellow birch plywood plates under constant shear stress.
1325  *Effect of a single reversal of stress on the static and impact bending strength of Sitka spruce and Douglas-fir.
1327  *The fatigue behavior of wood and plywood subjected to repeated and reversed bending stresses.

Supplements to 1327:
1327-A *The fatigue behavior of Douglas-fir and Sitka spruce subjected to reversed stresses superimposed on steady stresses.

1328  *Compression, tension, and shear tests on yellow-poplar plywood panels of sizes that do not buckle with tests made at various angles to the face grain.
1328-A *Compression tests.
1328-B *Tension tests.
1328-C *Shear tests.

1329  *Chemical stain in noble fir as related to strength.
Processed Reports

1500 *"Black streak" in Western hemlock: Its characteristics and influence on strength.
1501 *Thin-walled plywood cylinders in bending and torsion.
1502 *Thin-walled plywood cylinders in bending.
1503 *Stress-strain relations in wood and plywood considered as orthotropic materials.
1504 *Buckling loads of panels having light cores and dense faces.
1505 *Flexural rigidity of a rectangular strip of sandwich construction.

Supplements to 1505:
1505-A *Comparison between mathematical analysis and results of tests.
1507 *Rectangular plywood plates with the grain of the face plies inclined to the edges.
1508 *Buckling of thin, curved, plywood plates in axial compression.
1509 *Results of some tests on low-density materials.
1510 *Effect of elliptic or circular holes on the stress distribution in plates of wood or plywood considered as orthotropic materials.
1511 *Strength and related properties of balsa and quipo woods.
1512 *Strength of glued laminated Sitka spruce made up of rotary-cut veneer.
1513 *Effects of certain defects and stress-concentrating factors on the strength of tension flanges of box beams.
1514 *Effect of length on the buckling stresses of thin-walled, plywood cylinders in axial compression.
1515 *Distribution of strength values in wood for aircraft construction.
1516 *Survey of strength and related properties of yellow-poplar.
1518 *Effect of rapid loading and duration of stress on the strength properties of wood tested in compression and flexure.
1519 *Effect of moisture on the compressive, bending, and shear strengths, and on the toughness of plywood.
1520 *Effect of hydraulic-equipment oils on the bending and compressive strength of Sitka spruce.
1521 *Factors affecting the strength of papreg: Some strength properties at elevated and subnormal temperatures.
1521-A *Factors affecting the strength of papreg: Effect of accelerated weathering on certain strength properties of papreg.
1521-B *Factors affecting the strength of papreg: Effect of moisture on certain strength properties of papreg.
1521-C *Factors affecting the strength of papreg: Effect of repeated cycles of freezing and thawing on certain strength properties of papreg.
1522 *A comparison of shearing strengths of glued joints at various grain directions as determined by four methods of test.
MECHANICAL PROPERTIES (continued)

Processed Reports

1523  *Bolt-bearing strength of wood and modified wood: Effects of different methods of drilling bolt holes in wood and plywood.

Supplements to 1523:
1523-A  *Bearing strength of laboratory-made cross-banded yellow birch compreg under aircraft bolts.
1523-B  *Bearing strength of commercial cross-banded compreg under aircraft bolts.
1523-C  *Bearing strength of commercial aircraft plywood under aircraft bolts.
1523-D  *Bearing strength of wood members reinforced with plywood and cross-banded compreg under single and multiple aircraft bolts.
1524  *The influence of moisture changes in wood on the shearing strength of glued-joint assemblies.
1525  *Buckling loads of flat sandwich panels in compression. Various types of edge conditions.
1526  *Effects of variations in design on the strength of some typical glued fastenings in wood aircraft.
1527  *Effect of thickness of plywood reinforcing plates on the behavior of solid wood aircraft spars under changes in moisture content.
1528  *Elastic properties of wood: The Young's moduli, moduli of rigidity, and Poisson's ratios of balsa and quipo.

Supplements to 1528:
1528-A  *Young's moduli and Poisson's ratios of Sitka spruce and their relations to moisture content.
1528-B  *The moduli of rigidity of Sitka spruce and their relations to moisture content.
1528-C  *Young's Moduli, moduli of rigidity, and Poisson's ratios of mahogany and khaya.
1528-D  *Young's moduli and Poisson's ratios of Douglas-fir and their relations to moisture content.
1528-E  *The moduli of rigidity of Douglas-fir at about 11 percent moisture content.
1528-F  *Young's moduli, Poisson's ratios, and moduli of rigidity of sweetgum at approximately 11 percent moisture content.
1528-G  *Young's moduli, moduli of rigidity, and Poisson's ratios of yellow-poplar.
1528-H  *Young's moduli, moduli of rigidity, and Poisson's ratios of yellow birch.
1529  *Buckling of thin-walled plywood cylinders in torsion.
1540  *The use of wood for aircraft in the United Kingdom.
1543  *Impact resistance of three core materials and six sandwich constructions as measured by falling-ball tests.
1550  *Methods for testing and evaluating cargo flooring for transport aircraft.
1550-A  *Tests of cargo flooring L for aircraft.
MECHANICAL PROPERTIES (continued)

Processed Reports

1551 *Effect of increased moisture content on the shear strength at glue lines of box beams and on the glue-shear and glue-tension strengths of small specimens.
1552 *Moisture content of wood in airplane structures.
1553 *Buckling of stiffened, flat, plywood plates in compression -- a single stiffener perpendicular to stress.
1557 *The effective stiffness of a stiffener attached to a flat plywood plate.

Bulletins and Circulars


WOOD STRUCTURE

Technical Notes

209 *The structure of a softwood.
210 *The structure of a hardwood.

Processed Reports

1364 *Longitudinal shrinkage of balsa.
1390 *A simple device for detecting compression wood.
1391 *Radial streak (red) and giant resin ducts in spruce.
1392 *Western hemlock "floccosoids" (white spots or streaks).
1397 *A rapid method of determining the specific gravity of veneer.
1398 *A rapid method of estimating the approximate specific gravity of wood.
1585 *Guide to determining slope of grain in lumber and veneer.
1586 *Compression wood: Importance and detection in aircraft veneer and plywood.
1587 *A field method of determining specific gravity by use of increment cores or auger chips.

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WOOD STRUCTURE (continued)

Processed Reports

1588  *Detection of compression failures in wood.
1589  *Estimating the specific gravity of plywood.
1590  *A specific gravity chart for large-sized thin plywood panels.
1591  *Compression failures in wood detected by the application of carbon tetrachloride to the surface.
1592  *Instruments for rapidly measuring slope of grain in lumber.

Bulletins and Circulars


GLUES AND GLUING

Technical Notes

7-4  *Water-resistant glues.
104  *Overheating reduces strength of animal glue.
170  *Copper salts improve casein glue.
193  *Starved glue joints.
202  *Water-resistant cold press blood albumin glue.
207  *Glues for use with wood.
211  *Strong and weak glue joints.
223  *A factory method for testing hardness of glue joints.
227  *Tooth-planing or sanding not necessary to effect strong glued wood joints.
232  *Chemical treatment of surfaces improves glue joints in certain woods.
Processed Reports

68 *Factors that influence the decay of untreated wood in service and comparative decay resistance of different species. Revised 1941.
280 *Casein glues: their manufacture, preparation, and application. Revised 1939.
475 *Drying and conditioning of glued joints. Revised 1935.
492 *Animal glues: their manufacture, testing, and preparation. Revised 1937.
543 *Notes on the manufacture of flat plywood. Revised 1943.
869 *Important factors in gluing with animal glue.
1299 *The rate of temperature change in wood panels heated between hot plates. 1942.
1294 *Effect of extending hot-press, urea-resin glue with rye flour on strength and durability of the glue joints.
1332 *Increasing the durability of casein glue joints with preservatives.
1333 *Analysis for filler content of urea-formaldehyde glues.
1336 *Synthetic-resin glues.
1337 *Glues for use in aircraft.
1339 *Effects of elevated curing temperatures on the strength and durability of yellow birch plywood joints made with room-temperature-setting urea glues.
1340 *Control of conditions in gluing with protein and starch glues.
1342 *The gluing characteristics of 15 species of wood with cold-setting, urea-resin glues.
1343-A *Summary of a study of temperatures attained in a dummy aircraft wing during the summer at Madison, Wis.
1343-B *A study of temperatures attained in a dummy aircraft wing during the summer at Madison, Wis.
1344 *A procedure for measuring the mold resistance of protein glues.
1345 *Effect of high and low temperatures on resin glue joints in birch plywood.
1346 *Gluing of thin compreg.
1350 *Tests to determine the slipping properties of bag-molding glues in fluid stage.
1351 *Preliminary experiments to improve the gluing characteristics of refractory plywood surfaces by sanding.
1352 *Determination of degree of cure of low-temperature phenolic-resin glues by solubility methods.
1355 *A comparison of the durability of 23 urea resins in glue joints exposed to nearly saturated air at 75° C. (167° F.).
R1422 *Rate of setting of cold-setting, urea-resin glue joints.
R1434 *Experiments on the gluing of wood treated with oil solutions of chlorophenols.
GLUES AND GLUING (continued)

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R1486  *Development of shear strength in maple block joints made with
       two resorcinol glues at temperatures from 40° to 80° F.
1530  *Summary of information on the durability of aircraft glues.
1531  *Gluing with low-temperature-setting phenol, resorcinol, and
       melamine glues: Development of joint strength in birch ply-
       wood cured at several temperatures for various periods of time.
1532  *Stability of low-temperature-setting phenol, resorcinol, and
       melamine resin adhesives stored at 80° F.
1533  *Experiments to develop a rapid durability test for urea-resin
       glues.
1534  *Effect of moisture content of wood on joint strength in gluing
       birch veneer and maple lumber with room-temperature-setting
       and intermediate-temperature-setting phenol, resorcinol, and
       melamine glues.
1535  *Effect of closed assembly time on joint strength in gluing with
       low-temperature-setting phenol, resorcinol, and melamine glues.
1536  *Durability of glue joints between blocks of compreg and of
       compreg and wood.
1537  *Durability of room-temperature-setting and intermediate-setting
       resin glues cured to different degrees in yellow birch plywood.
1538  *Durability of pepreg-to-papreg and papreg-to-birch glued joints.
1539  *Resistance of several types of glue in wood joints to fatigue
       stressing.
1541  *Bleed-through of glue in aircraft plywood.
1542  *Strength of joints in hard maple blocks, glued with certain resin
       glues, after various open and closed assembly periods.
1544  *Weight and dimensional stability of three low-density core
       materials.
1545  *Resistance to fatigue stressing of wood-to-metal joints glued with
       several types of adhesives.
1546  *Variation in maximum allowable assembly time with年龄 in the pot
       at time of spreading for four resin glues.
1547  *Rate of development of joint strength by four resin glues on
       eight species of wood.
1548  *Tensile strength at elevated temperature of glued joints between
       aluminum and end-grain balsa.
R1624  *Fluid-pressure molding of plywood.

Bulletins and circulars

Effectiveness of moisture-excluding coatings on wood, by G. M. Hunt.

SEASONING

Technical Notes

D-5  *Correct moisture content of lumber.
F-13  *Moisture content of wood at different humidities.
181  *Coatings for minimizing changes in the moisture content of wood.
239  *An instrument for measuring wood equilibrium moisture content.
241  *Shrinkage table for softwood lumber.

Processed Reports

1360  *Dry-kiln temperature schedules for aircraft lumber.
1362  *Suggestions and instructions for kiln operators drying aircraft lumber.
1363  *Shrinkage of wood.
1365  *Moisture content of aircraft lumber.
1366  *Air-seasoned aircraft stock.
1367  *Kiln-drying essentials for aircraft stock.
1368  *Tests for kiln-dried aircraft lumber.
1369  *Kiln-drying defects.
1370  *Conditioning and storing of air-dried and kiln-dried aircraft stock.
1371  *The relief of casehardening stresses in aircraft lumber.

Bulletins and circulars


Kiln Certification. ANC Bulletin 21. 75¢.
Processed Reports

1368 *Resin-treated, laminated, compressed wood.
1319 *Strength and related properties of Forest Products Laboratory laminated paper plastics (papreg) at normal temperature.
1321 *The effect of temperature on certain mechanical properties of Forest Products Laboratory high-strength, cross-laminated paper plastic (papreg).
1348 *The gluing of laminated paper plastic (papreg).
1380 *Forest Products Laboratory resin-treated wood (impreg).
1381 *Forest Products Laboratory resin-treated, laminated, compressed wood (compreg).
1383 *Effect of resin treatment and compression upon the properties of wood.
1384 *Comparison of commercial water-soluble phenol-formaldehyde resins for wood impregnation.
1385 *The electrical resistivity of resin-treated wood (impreg and compreg), hydrolyzed wood sheet (hydroxylin), and laminated resin-treated paper (papreg).
1386 *Influence of manufacturing variables on the impact resistance of resin-treated wood.
1387 *Effect of papreg of six water-alcohol ratios used as diluents of impregnating resins.
1389 *Certain properties of papreg affected by calendering pressure on Mitscherlich base paper.
1393 *Sulfite pulps for high-strength laminated paper plastics: Pulping variables and properties of black spruce pulps, papers, and plastics.
1394 *Effect of lamination pressure on certain properties of high-strength paper plastic.
1399 *Sulfite pulps for papreg: Base papers and laminates from black spruce, balsam fir, Western hemlock, and grand fir.
1575 *Certain properties of papreg affected by wet-press pressure on Mitscherlich base paper.
1580 *Heat stabilized compressed wood (stapak).
1581 *Strength losses of papreg due to bag-molding defects.
1594 *Development of a counterpart vertical fin of papreg for the AT-6 airplane.
1595 *Properties of laminated plastics made from lignin and lignin-phenolic resin-impregnated papers.
1596 *Sulfite pulp for papreg: Laminates from pulps made from short and standard length black spruce chips.
1593 *Acetylated wood.
1595 *Properties of laminated plastics made from lignin and lignin-phenolic resin-impregnated papers.
Processed Reports

1375 *The significance of the discolorations in aircraft veneers: yellow-poplar.
1376 *The significance of the discolorations in aircraft veneers: sweetgum.
1377 *The significance of the discolorations in aircraft veneers: yellow birch.
1378 *Recommended practice for controlling sap stain in aircraft yellow-poplar lumber.
1379 *The significance of the discolorations in aircraft veneers: mahogany and khaya.
1380 *Decay of wood in aircraft.
1381 *Decay resistance of oak wood.
1381 *The significance of the discolorations in aircraft veneers: American beech.
1382 *Significance of air-dry wood in controlling rot caused by *Poria incrassata.
1383 *Diagnostic features of some discolorations common to aircraft hardwoods.
1384 *The significance of the discolorations in aircraft lumber: Sitka spruce.
1385 *Breaking radius of discolored wood in aircraft veneers.
1386 *The significance of black line stain in yellow birch propeller lumber.
1387 *The significance of the discolorations in aircraft lumber: noble fir and Western hemlock.
1388 *Molds and bacteria that delaminate plywood bonded with casein and soybean glues.
1389 *Lumber shipped green can be protected against decay.
1390 *Sapstain control treatments before or after dressing.
1391 *Chemical dipping treatments for controlling molding and staining of wood boxes and crates.

Bulletins and Circulars


FINISHING

Technical Notes

228 *Aluminum coatings for moisture-proofing wood.

Processed Reports

1396 *Finishing wood in aircraft.
1597 *Study of temperature and moisture content in wood aircraft wings in different climates.
1598 *Moisture excluding effectiveness and weight of aircraft finishes on paper and on plywood.

MISCELLANEOUS

Technical Notes

234 *Longitudinal shrinkage of wood.
248 *Computed thermal conductivity of common woods.

Processed Reports

R1146 *Electrical moisture meters for wood, by M. E. Dunlap. (Original article in Timberman, Oct. 1937.)

Trade Journal Articles


Wood in aircraft construction, prepared by Forest Products Laboratory. Aircraft design data No. 12, issued by Navy Dept., U. S. Bureau of Construction & Repair, 1919. (Comprehensive treatise on selection, strength, seasoning, gluing, fabrication, and strength of parts, etc.). Out of print.
MISCELLANEOUS (continued)

Bulletins and Circulars


Wood handbook: Basic information on wood as a material of construction with data for its use in design and specifications, by Forest Products Laboratory, U. S. Dept. Agr. unnumbered publication. 1935, slightly revised in 1940. 50¢.


Repair of Wood Aircraft Structures. Information presented based largely on tests and engineering investigations conducted on wood and plywood by the Forest Products Laboratory. Available from Commanding General, Attn: Publications Distribution Branch, Fairfield Air Service Command, Patterson Field, Ohio.

TYPEWRITTEN REPORTS

(Not available for general distribution, but available for loan for 7 days on application to the Forest Products Laboratory, Madison, Wisconsin.)

Project number

221-1BJ1 The strength of black walnut as related to its shades of color, by R. F. Luxford. April 11, 1923.


233-13 Toughness tests of airplane woods:
Project number

243 The relation between color and toughness strength in commercial white ash, by R. H. Colley. April 16, 1924.


Reports and Technical Notes prepared by the Forest Products Laboratory and published by the

NATIONAL ADVISORY COMMITTEE FOR AERONAUTICS

(For sale by the Superintendent of Documents, Government Printing Office, Washington, D. C., or if out of print, available for reference or loan from the Committee.)

Report number

474 Nomenclature for aeronautics, by NACA. 1933. 10¢.
382 Elastic instability of members having sections common in aircraft construction, by G. W. Trayer and H. W. March. 1931. 25¢.
344 The design of plywood webs for airplane wing beams, by G. W. Trayer. 1930. 10¢.
334 The torsion of members having sections common in aircraft construction, by G. W. Trayer and H. W. March. 1930. 25¢.
251 Approximations for column effect in airplane wing spars, by E. P. Warner and Mac Short. 1926. 10¢.

Tech. Note
Number

296 Bearing strength of wood under steel aircraft bolts and washers and other factors influencing fitting design, by G. W. Trayer. Oct. 1928.
OTHER PUBLICATION LISTS ISSUED BY THE FOREST PRODUCTS LABORATORY

The following lists of publications which deal with the other investigative projects of the Forest Products Laboratory are obtainable upon request:

Boxing and Crating -- Strength and serviceability of shipping containers, methods of packing.

Building Construction Subjects -- Partial list of Government publications of interest to architects, engineers, builders, and retail lumbermen.

Chemistry of Wood and Derived Products -- Chemical properties and uses of wood and chemical wood products, such as turpentine, alcohol, and acetic acid.

Fungus Defects in Forest Products (Pathology in cooperation with the Bureau of Plant Industry) -- Heart rots of trees; decay, molds, and stains in timber, in buildings, and in wood products; antiseptic properties of wood preservatives.

Glue and Plywood -- Development of waterproof glues, preparation and application of various glues, plywood manufacturing problems.

Growth, Structure, and Identification of Wood -- Structure and identification of wood; the effect of cellular structure of wood on its strength, shrinkage, permeability, and other properties; the influence of environmental factors such as light, soil, moisture, and fire, on the quality of wood produced; and secretions of economic value produced by trees and their exploitation.

Logging, Manufacturing, and Utilization of Timber, Lumber, and Other Wooden Products -- Methods and practices in the lumber-producing and wood-consuming industries; standard lumber grades, sizes, and nomenclature; production and use of small dimension stock; specifications for small wooden products; uses for little-used species and commercial woods, and low-grade and wood-waste surveys.

Mechanical Properties of Timber -- Strength of timber and factors affecting strength; design of wooden articles or parts where strength or resistance to external forces is of importance.

Pulp and Paper -- Suitability of various woods for pulp and paper; fundamental principles underlying the pulping and bleaching processes; methods of technical control of these processes; relation of the chemical and physical properties of pulps and the relation of these properties to the paper-making qualities of the pulps; waste in the industry, for example, decay in wood and pulp, utilization of bark, white water losses, etc.
Seasoning of Wood -- Experimental and applied kiln drying, physical properties, air drying, steam bending.

Wood Finishing Subjects -- Effect of coatings in preventing moisture absorption; painting characteristics of different woods and weathering of wood.

Wood Preservation -- Preservative materials and methods of application; durability and service records of treated and untreated wood in various forms.