



NATIONAL BOARD FOR TECHNICAL EDUCATION

PLOT B BIDA ROAD, P.M.B. 2239, KADUNA, NIGERIA

HIGHER NATIONAL DIPLOMA IN

WOOD AND PAPER TECHNOLOGY (WOOD PRODUCTS PROCESSING TECHNOLOGY)

CURRICULUM AND COURSE SPECIFICATIONS

JUNE, 2026

PREFACE

The transformation of Nigeria's agricultural sector remains central to the nation's aspirations for sustainable economic growth, food security, job creation, industrial development, and poverty reduction. As agriculture continues to evolve in response to technological advancements, climate change, emerging global market demands, and the need for increased productivity across agricultural value chains, it has become imperative to ensure that curricula in Nigerian tertiary institutions remain relevant, responsive, and aligned with contemporary industry requirements. It is against this backdrop that we embarked on the comprehensive review and modernization of Agricultural curricula for Nigerian tertiary institutions. The review process was designed to address identified skills gaps, integrate emerging technologies and innovations, strengthen entrepreneurship and employability competencies, promote climate-smart agriculture, and align training programmes with the industry expectations and global best practices. The successful execution of this important project was made possible through the invaluable support and commitment of key stakeholders. I wish to express profound appreciation to the Honourable Minister of Education for providing the policy direction and leadership that facilitated this initiative. I also extend sincere gratitude to the Honourable Minister of Agriculture and Food Security and the Honourable Minister of Livestock Development for their unwavering support, technical contributions, and commitment to strengthening agricultural education and workforce development in Nigeria. Special appreciation goes to the Tertiary Education Trust Fund (TETFund) for providing the special intervention grant that enabled the conduct of nationwide skills gap analyses and supported the series of national curriculum review and development workshops. The findings from the skills gap studies provided critical evidence and industry insights that guided the review process and ensured that the curricula reflect current and future workforce requirements within the agricultural sector.

I also acknowledge with gratitude the immense contributions of the Sector Skills Council for Agriculture, whose expertise and industry perspectives greatly enriched the curriculum development process. Equally commendable are the efforts of members of the Implementation Committee, resource persons, industry experts, professional bodies, French Embassy in Nigeria, regulatory agencies, academic institutions, employers, development partners, and other stakeholders who devoted their time, knowledge, and experience to the various workshops and technical sessions. The revised curricula represent a collective national effort to produce graduates equipped with relevant knowledge, practical skills, digital competencies, entrepreneurial capabilities, and professional attitudes required to drive innovation and productivity across Nigeria's agronomy, forestry, fisheries and livestock sectors. It is my expectation that Institutions offering these programmes will faithfully implement the curricula and continue to collaborate with industry to ensure sustained relevance and quality. I commend all stakeholders for their dedication and contributions to this landmark achievement and look forward to the successful implementation of these curricula for the benefit of our dear nation.

Professor Idris M. Bugaje, FNSE
Chairman, Implementation Committee

EXECUTIVE SECRETARY

National Board for Technical Education (NBTE), Kaduna

ACKNOWLEDGEMENT

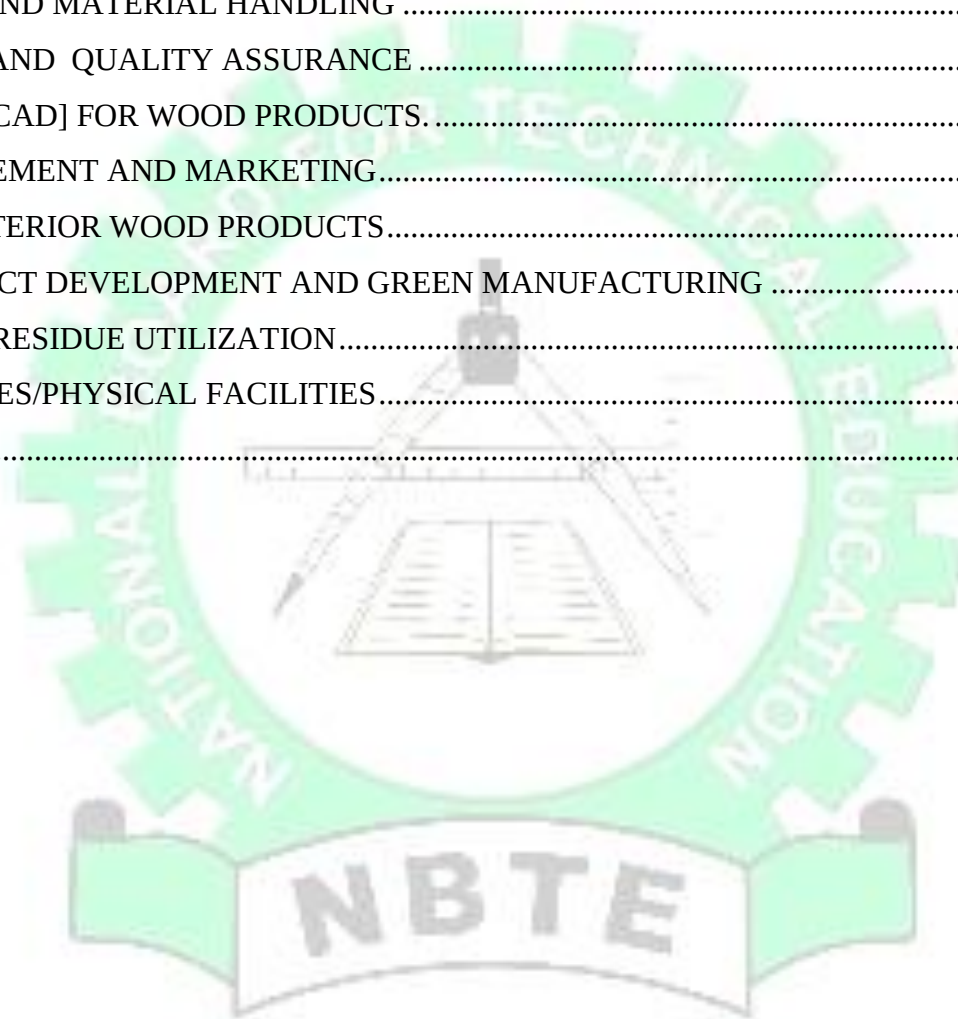
The National Board for Technical Education (NBTE) expresses its profound appreciation to all individuals and organizations whose invaluable support, expertise, and commitment made the successful review and modernization of the Agricultural Education curricula for Nigerian tertiary institutions possible. Our sincere gratitude goes to the Honourable Minister of Education for providing the policy direction and leadership that made this national initiative possible. We also appreciate the Honourable Minister of Agriculture and Food Security and the Honourable Minister of Livestock Development for their technical guidance, collaboration, and unwavering commitment to strengthening agricultural education and workforce development in Nigeria. The Board is particularly grateful to the Tertiary Education Trust Fund (TETFund) for providing the special intervention grant that funded the nationwide skills gap analyses, stakeholder engagements, curriculum review exercises, validation meetings, and development workshops. The evidence generated through these studies provided a solid foundation for developing curricula that are relevant, industry-driven, and responsive to national and global agricultural priorities.

Special appreciation is extended to the members of the agriculture, curriculum specialists, resource persons, academic experts, professional bodies, regulatory agencies, employers, industry practitioners, development partners, and representatives of public and private sector organizations who participated actively in the skills gap studies, technical sessions, validation exercises, and curriculum development workshops. Their diverse expertise and practical insights greatly enriched the quality and relevance of the curricula. We further appreciate the support of the French Embassy in Nigeria and other development partners for their collaboration in promoting excellence and innovation in technical and vocational education within the agricultural sector. Finally, NBTE expresses its gratitude to all tertiary institutions, researchers, facilitators, rapporteurs, technical staff, and administrative personnel whose commitment and hard work contributed to the successful completion of this important national assignment. The Board acknowledges that this achievement is the result of a collective effort and remains confident that the effective implementation of these curricula will contribute significantly to producing competent, innovative, and entrepreneurial graduates capable of advancing sustainable agricultural development, food security, and economic prosperity in Nigeria

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GENERAL INFORMATION

1.0 TITLE OF THE PROGRAMME

The title of the programme is Higher National Diploma (HND) in Wood and Paper Technology (Wood Products Processing Technology Option).

2.0 PROGRAMME GOAL

The Higher National Diploma (HND) programme in Wood and Paper Technology (Wood Products Processing Technology Option) is designed to produce skilled technologists with adequate knowledge, practical skills, and professional attitudes for effective utilization, processing, management, and conservation of wood resources.

3.0 OBJECTIVES OF THE PROGRAMME

At the end of the programme, the diplomates should be able to:

- i. Carry out wood processing and paper production operations using appropriate technologies and equipment;
- ii. Apply principles of wood science and paper technology in the utilization and management of forest products;
- iii. Operate machines and equipment used in wood conversion and sawmilling industries;
- iv. Conduct quality control and quality assurance tests on wood, paper, and related products;
- v. Utilize suitable wood species for furniture, construction, pulp and paper, flooring, and joinery industries;
- vi. Apply sustainable forest management and environmental conservation practices in wood and paper industries;
- vii. Assist in research and development activities in wood processing and technology;
- viii. Apply safety practices and industrial regulations in wood workshops and wood industries;
- ix. Participate in timber harvesting, seasoning, preservation, and storage operations;
- x. Utilize waste wood and paper materials for recycling and value-added products;
- xi. Apply principles of circular bioeconomy and sustainable packaging systems in wood industries;
- xii. Carry out environmental impact assessment and pollution control measures in forest product industries;
- xiii. Implement timber traceability and forest certification procedures for sustainable resource management;
- xiv. Prepare technical reports, production records, and documentation related to wood operations;
- xv. Apply entrepreneurial and managerial skills in establishing and managing wood enterprises;
- xvi. Collaborate effectively with professionals and stakeholders in forestry, wood, and paper industries;
- xvii. Use modern technologies and innovations in advanced sawmilling and related wood technologies;
- xviii. Promote sustainable utilization of forest resources for economic growth and environmental protection.

4.0 ENTRY REQUIREMENTS

The general entry requirements into the Higher National Diploma (HND) in Wood and Paper Technology (Wood Products Processing Technology Option) are:

- i) Candidates with National Diploma in Wood and Paper Technology or related programmes with at least Lower Credit, from accredited Institutions.
- ii) Must have undergone one (1) year post-ND industrial training experience;
- iii) Candidates with a **Pass** at the ND Level with two (2) or more years post-ND cognate work experience may be considered for admission.
- iv) Credit passes in five ordinary level subject at not more than two sitting including English, Mathematics, Biology/Agricultural Science and two other related subjects.

5.0 STRUCTURE/DURATION OF THE PROGRAMME

The HND Wood and Paper Technology (Wood Products Processing Technology Option) is a terminal programme structured to last for two (2) years (four semesters) of classroom work, laboratory, field trip and workshop practices in relevant MDAs or Units.

Each semester shall be for 17 weeks, made up as follows:

- i) 15 contact weeks of teaching (i.e., lectures and practical sessions etc.) and
- ii) 2 weeks for registration, tests, quizzes and examinations.

6.0 CURRICULUM

The syllabus of the HND Wood and Paper Technology (Wood Products Processing Technology Option) consists of four (4) main components:

- a. General studies/General education courses
- b. Foundation courses
- c. Professional courses
- d. Project work

7.0 STAFFING REQUIREMENTS

7.1 Core Teaching Staff:

A minimum of four (4) Core Lecturers who should be Lecturer II or above staff, with a minimum qualification of HND/B.Sc in Wood and Paper Technology, Wood Products Processing Technology, Paper and Paper Products Technology, Forestry and Environmental Technology or related programmes.

7.2 Headship of the Department:

The Head of Department shall have at least a First HND or degree and Master's degrees in Wood Products Processing Technology, Paper and Paper Products Technology, Wood and Paper Technology, Wood Science, Forestry and Environmental Technology, Wood Science/Wood Technology or related fields. He or she shall not be below the rank of a Senior Lecturer, must be registered with the relevant professional body and must have a minimum of twelve (12) years experience in both academic and industry.

7.3 Technical Staff

There should be technical staff:

i) Technologist

A technologist is a highly skilled professional trained at the Higher National Diploma (HND) level. They possess advanced technical and practical knowledge in their field and are capable of supervising operations, managing projects, operating modern equipment, and applying technology to solve practical problems. In agriculture, technologists help in farm management, research support, and the application of improved technologies.

ii) Technician

A technician is a middle-level manpower trained at the National Diploma (ND) level. Technicians are responsible for carrying out technical tasks, operating tools and equipment, and assisting technologists and professionals in practical activities. In agriculture, they assist in crop production, livestock management, farm maintenance, and data collection.

iii) Farm Assistants

Farm assistants are support workers who help in daily farm operations under supervision. They perform basic practical activities such as planting, weeding, feeding animals, harvesting, cleaning farm tools, and maintaining farm records. They contribute to the smooth running of farm activities and help improve productivity.

7.4 CAREER AND ACADEMIC PROSPECTS

Holders of the HND in Wood Products Processing Technology are eligible for direct admission into relevant post graduate programmes and can work in public or private establishments or organizations such as:

- Wood processing industries;
- Paper mills and paper processing industries;
- Sawmilling Industries;
- Furniture Production Industries;
- Quality Control Office;
- Environmental and Sustainability Office;
- Military/Para-military;
- Non-Governmental Organizations (NGOs) etc. or
- Can be a successful enterprenuer in wood based business enterprises.

8.0 CERTIFICATION

A diplomate of this Programme shall be awarded the Higher National Diploma (HND) in Wood and Paper Technology (Wood Products Processing Technology Option)

9.0 AWARD OF HIGHER NATIONAL DIPLOMA (HND)

The Higher National Diploma certificate in Wood and Paper Technology (Wood Products Processing Technology Option) shall be awarded by the authority of the Academic Board of the institution under the following conditions:

- i) Satisfactory performance in all prescribed course work/assignments, tests/quizzes, workshop practice, laboratory work, field trips, etc.;
- ii) Satisfactory performance in all semester examinations;
- iii) Satisfactory completion of written project/seminar papers.

9.1 Conditions for the Award of HND:

Institutions offering accredited programmes will award the Higher National Diploma to candidates who successfully completed the programme after passing the prescribed course-work, examinations, diploma project etc. Courses shall be graded as follows:

MARKS RANGE	LETTER GRADE	WEIGHTING
75% and above	A	4.00
70% – 74%	AB	3.50
65% – 69%	B	3.25
60% – 64%	BC	3.00
55% – 59%	C	2.75
50% – 54%	CD	2.50
45% – 49%	D	2.25
40% – 44%	E	2.00
Below 40%	F	0.00

9.2 Classification of Diplomas:

Diploma Certificates shall be awarded based on the following classifications:

CGPA	CLASS OF DIPLOMA
CGPA 3.50 and above	Distinction
CGPA 3.00-3.49	Upper Credit
CGPA 2.50-2.99	Lower Credit
CGPA 2.00-2.49	Pass

10.0 ACCREDITATION OF PROGRAMME

The HND Wood and Paper Technology (Wood Products Processing Technology Option) shall be accredited by the NBTE before the diplomates are awarded the certificates. Details about the process of accrediting a programme for the award of HND are available from the Board's website web.nbte.gov.ng or through correspondence to: The Executive Secretary, NBTE, Plot 'B' Bida Road, P.M.B 2239, Kaduna, Nigeria.

11.0 LOGBOOK

A personal logbook for each course is to be kept by the students. It shall contain all the recordings of the day-to-day, weekly and semester practical works/activities from day one to the end of the programme. This is to be checked, marked appropriately and endorsed by all lecturers concerned at the end of every week.

12.0 FINAL YEAR PROJECTS

Final year students are expected to carry out project work, either on individual or group basis (not more than 2 per group). The project topics should as much as possible be related to the programme and serve as useful tools for further Research and /or Development. Projects should be properly supervised, and their reports well presented. The Institution should develop formats for presenting and grading projects. The formats should be adopted as applied to each stakeholder.

13.0 GUIDANCE NOTES FOR TEACHERS OF THE PROGRAMME

13.1 The new curriculum is drawn in unit courses. This is in keeping with the provisions of the National Policy on Education which stress the need to introduce the semester credit units which will enable a student, who so wishes, to transfer the units already completed in an institution of similar standard from which he/she is transferring.

13.2 In designing the units, the principle of the modular system by product has been adopted, thus making each of the professional modules, when completed provides the student with technician operative skills, which can be used for employment purposes.

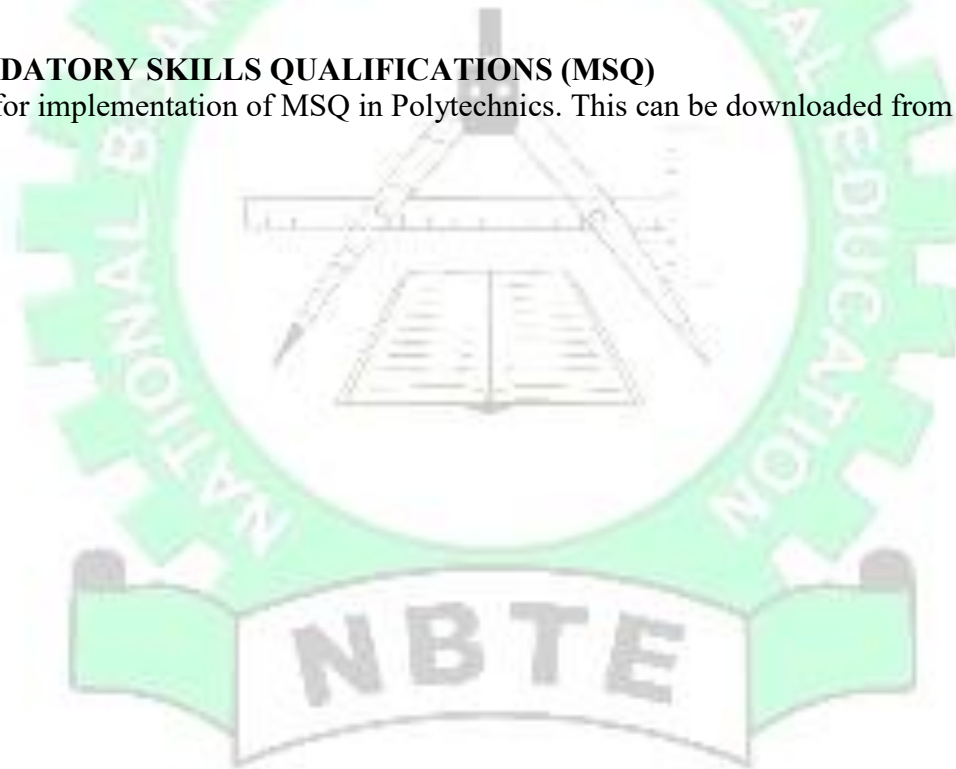
13.3 As the success of the credit unit system depends on the articulation of programmes between the institution and industry, the Curriculum content has been written in behavioral objectives, so that the expected performance of the student is clear to all students who successfully completed some of the courses or the diplomates of the programme. There is a slight departure in the presentation of the performance-based

curriculum which requires the conditions under which the performance is expected to be carried out and the criteria for the acceptable levels of performance. It is a deliberate attempt to further involve the staff of the department teaching the programme to write their own curriculum stating the conditions existing in their institution under which the performance can take place and follow that with the criteria for determining an acceptable level of performance. Departmental submission on the final curriculum may be vetted by the Academic Board of the institution. Our aim is to continue to see to it that a solid internal Evaluation system exists in each institution for ensuring minimum standard and quality of education in the programmes offered throughout the polytechnic system.

13.4 The teaching of theory and practical work should, as much as possible, be integrated. Practical exercises, especially those in professional courses and laboratory work should not be taught in isolation from the theory. For each course, there should be a balance of theory to practice in the ratio of 50:50 or 60:40 or the reverse.

14.0 GUIDELINES ON MANDATORY SKILLS QUALIFICATIONS (MSQ)

Please, refer to NBTE guidelines for implementation of MSQ in Polytechnics. This can be downloaded from NBTE website (web.nbte.gov.ng)



CURRICULUM TABLE**YEAR I SEMESTER I**

S/N	COURSE CODE	COURSE TITLE	L	T	P	CU	CH
1.	GNS 301	Use of English III	2	0	0	2	2
2.	MSQ 311	Principles of Quality Assurance Assessment	1	0	1	2	2
3.	WPT 311	Wood Anatomy and Commercial Timber Identification	1	0	3	4	4
4.	WPT 312	Wood Chemistry	1	0	2	3	3
5.	WPT 313	Wood Physics	1	0	2	3	3
6.	WPT 314	Timber Harvesting, Conversion and Processing Systems	1	0	3	4	4
7.	WPT 315	Wood Seasoning	1	0	3	4	4
8.	WPT 316	Computer Applications in Wood and Paper Technology	1	0	3	4	4
9.	WPT 317	Industrial Safety, Health and Environmental Management	1	0	2	3	3
10.	WPT 318	Climate Change and Forest Resources	1	0	1	2	2
TOTAL			11	0	20	31	31

YEAR I SEMESTER II

S/N	COURSE CODE	COURSE TITLE	L	T	P	CU	CH
1.	GNS 302	Communication in English III	2	0	0	2	2
2.	GNS 321	General Philosophy	2	0	0	2	2
3.	ENT 326	Practice of Entrepreneurship I	2	0	2	4	4
4.	MSQ 321	Practice of Quality Assurance Assessment	1	0	1	2	2
5.	AGR 302	Field Experimentation and Data Analysis	1	0	1	2	2
6.	WPT 321	Environmental Impact Assessment in Wood Production	1	0	1	2	2
7.	WPT 322	Sawmilling and Timber Processing Technology	1	0	3	4	4
8.	WPT 323	Forest Operations and Techniques	1	0	3	4	4
9.	WPT 324	Forest Certification and Timber Traceability	1	0	3	4	4
10.	WPT 325	Wood Waste Utilization and Circular Bioeconomy	1	0	3	4	4
11.	WPT 326	Biodeterioration of Wood	1	0	2	3	3
12.	WPT 327	Pulping Processes	1	0	2	3	3
TOTAL			15	0	21	36	36

YEAR II SEMESTER I

S/N	COURSE CODE	COURSE TITLE	L	T	P	CU	CH
1.	GNS 401	Communication in English IV	2	0	0	2	2
2.	ENT 416	Practice of Entrepreneurship II	2	0	2	4	4
3.	AGR 401	Research Methodology and Scientific writing	1	0	1	2	2
4.	WPP 411	Wood Composite and Engineered Wood Products	1	0	3	4	4
5.	WPP 412	Wood Finishing, Adhesives and Surface Coating Technology	1	0	3	4	4
6.	WPP 413	Yard Operations and Material Handling	1	0	2	3	3
7.	WPP 414	Wood Product Testing and Quality Assurance	1	0	3	4	4
8.	WPP 415	Computer-Aided Design (CAD) for Wood Products	1	0	3	4	4
9.	WPP 416	Sustainable Forest Products and Climate-Smart Technologies	2	0	0	2	2
TOTAL			12	0	17	29	29

YEAR II SEMESTER II

S/N	COURSE CODE	COURSE TITLE	L	T	P	CU	CH
1.	GNS 411	Introduction to Psychology	2	0	0	2	2
2.	WPP 421	Wood Enterprise Management and Marketing	1	0	3	4	4
3.	WPP 422	Furniture Design and Interior Wood Products	1	0	3	4	4
4.	WPP 423	Wood Innovation, Product Development and Green Manufacturing	1	0	3	4	4
5.	WPP 424	Biomass, Bioenergy and Residue Utilization	1	0	3	4	4
6.	WPP 427	Project	0	0	4	4	4
TOTAL			6	0	16	22	22

KEY: L - Lectures (Hours/week), T - Tutorials(Hours/week), P -Practical(Hours/week), CU - Credit Unit, CH - Contact Hour (Hours/Week)

WOOD ANATOMY AND IDENTIFICATION

PROGRAMME: HIGHER NATIONAL DIPLOMA WOOD AND PAPER TECHNOLOGY (WOOD PRODUCTS PROCESSING TECHNOLOGY OPTION)		
COURSE TITLE: WOOD ANATOMY AND IDENTIFICATION	COURSE CODE: WPT 311	CONTACT HOURS: 4HOURS/WEEK
	CREDIT UNIT: 4	THEORETICAL: 1HOUR/WEEK
YEAR: 1 SEMESTER:1	PRE-REQUISITE: NIL	PRACTICAL:3 HOURS/WEEK
GOAL: This course is designed to equip students with the knowledge and skills in anatomy and identification of wood.		
GENERAL OBJECTIVES: On completion of this course, the students should be able to: 1.0 Understand wood anatomy and structure; 2.0 Comprehend commercial timber species using anatomical and physical characteristics; 3.0 Understand the relationship between wood structure and utilization; 4.0 Apply wood identification techniques for industrial and commercial purposes.		

PROGRAMME: HIGHER NATIONAL DIPLOMA WOOD AND PAPER TECHNOLOGY (WOOD PRODUCTS PROCESSING TECHNOLOGY OPTION)						
COURSE TITLE: WOOD ANATOMY AND IDENTIFICATION		COURSE CODE: WPT 311		CONTACT HOURS: 4 HOURS/WEEK		
		CREDIT UNIT: 4		THEORETICAL:1HOUR/WEEK		
YEAR: I SEMESTER: I		PRE-REQUISITE: NIL		PRACTICAL: 3 HOURS/WEEK		
COURSE SPECIFICATION: THEORETICAL AND PRACTICAL						
GOAL: This course is designed to equip students with the knowledge and skills in anatomy and identification of wood.						
GENERAL OBJECTIVE 1.0: Understand wood anatomy and structure						
THEORETICAL CONTENT				PRACTICAL CONTENT		
Week	Specific Learning Outcome	Teacher’s Activities	Resources	Specific Learning Outcome	Teacher’s Activities	Resources
1-3	1.1 Describe the internal structure of wood: i. Pith ii. Bark iii. Cambium iv. Sapwood v. Heartwood 1.2 Differentiate between hardwood and softwood. 1.3 Define the following terms: • annual rings • pores • rays • canal zones. 1.4 Explain growth rings and grain patterns using local species examples.	• Explain wood structure using diagrams and wood samples. • Distinguish between hardwood and softwood. • Explain the term annual rings, pores, rays and canal zones. • Explain growth rings and grain patterns • Explain cellular components of hardwoods and softwoods • Distinguish between macroscopic and microscopic wood anatomy. • Explain wood grain characteristics and growth patterns	Whiteboard and marker, Projector, charts, textbooks, internet, lecture notes, etc.	• Identify wood anatomical parts; e. g Micro and macro parts for different wood species. • Identify growth increments using hand lens or microscope. • Identify annual rings, pores, rays and canal zones.	Guide student to: • Identify wood anatomical parts; e. g Micro and macro parts for different wood species. • Identify growth increments using hand lens or microscope. • Identify annual rings, pores, rays and canal zones.	Timber specimens, Razor blade, Hand lens, Microscope, Practical manual, Measuring tools, PPEs, Petri dishes Wood dissecting kits Cover slips Slides Wash bottles Lactophenol

	1.5 Describe cellular components of hardwoods and softwoods: •Vessels •Fibres •Parenchyma •Tracheid •Rays 1.6 Distinguish between macroscopic and microscopic wood anatomy. 1.7 Describe wood grain characteristics and growth patterns. 1.8 Explain factors affecting wood formation and structure.	• State factors affecting wood formation and structure.				
General Objective 2.0: Understand the microscopic anatomical features of wood.						
4-7	2.1 Define, wood microscopic structures such as parenchyma, collenchyma, sclerenchyma, phloem, xylem etc. 2.2 Explain the structures above in 2.1 2.3 Describe the arrangements and functions of cells of	• Explain wood microscopic structures such as; parenchyma, collenchyma, sclerenchyma, phloem, xylem etc. • Explain the arrangements and functions of cells of the structures identified in 2.1. above • Describe the arrangements and functions of cells of the structures identified in 2.2	Whiteboard and marker, Projector, charts, textbooks, internet, lecture notes, etc.	• Identify wood microscopic structures such as parenchyma, collenchyma, sclerenchyma, phloem, xylem etc.	Guide student to: • Identify wood microscopic structures such as parenchyma, collenchyma, sclerenchyma, phloem, xylem etc.	Wood anatomy charts, Wood cross-sections, Microscope, projector, Timber

	the structures identified in 2.2 above.	above				
General Objective 3.0: Comprehend commercial timber species using anatomical and physical characteristics						
8-11	3.1 Describe major indigenous timber species and their characteristics 3.2 Describe major exotic timber species: Teak, Gmelina, Pine, Eucalyptus etc. 3.3 Explain physical properties of wood: colour, texture, odour, density, hardness and grain. 3.4 Explain the use of botanical and local names in timber identification. 3.5 Classify timber species based on physical and structural properties. 3.6 Describe the use of these commercial timbers identified in 3.5 above based on their characteristics such as working properties, density, etc.	• Discuss major indigenous timber species and their characteristics: e.g Iroko, Mahogany, Obeche, Opepe, Afara, Apa • Discuss major exotic timber species: Teak, Gmelina, Pine, Eucalyptus etc. • Explain physical properties of wood: colour, texture, odour, density, hardness and grain. • Explain the use of botanical and local names in timber identification. • Classify timber species based on physical and structural properties.	Whiteboard and marker, Projector, charts, textbooks, internet, lecture notes, etc.	• Identify at least 30 hard wood timber species using the presence of such features as ray cells, parenchyma, pores, canals, sapwood colour and depth, heartwood colour and annual rings, etc. • Identify at least 5 soft wood timber species using the presence of such features as ray cells, parenchyma, pores, canals, sapwood colour and depth, heartwood colour and annual rings, etc. • Identify exotic timber species and their characteristics • Cut wood sections and mount same on slides. • Identify gross wood	Guide students to: • Identify at least 30 hard wood timber species using the presence of such features as ray cells, parenchyma, pores, canals, sapwood colour and depth, heartwood colour and annual rings, etc. • Identify at least 5 soft wood timber species using the presence of such features as ray cells, parenchyma, pores, canals, sapwood colour and depth, heartwood colour and annual rings, etc. • Identify exotic	Timber samples, weighing balance, Density measuring tools, Timber identification guide, Practical manual etc.

				feature visually or with microscope • Identify wood species using dichotomous key card system	timber species and their characteristics • Cut wood sections and mount same on slides. • Identify gross wood feature visually or with microscope • Identify wood species using dichotomous key card system	
General Objective 4.0: Apply wood identification techniques for industrial and commercial purposes						
12-15	4.1 Explain standard procedures for timber identification in industries. 4.2 Explain the role of timber identification in quality control and marketing. 4.3 Explain digital tools used in timber identification and inventory systems. 4.4 Explain timber traceability and documentation systems.	• Discuss standard procedures for timber identification in industries. • Explain the role of timber identification in quality control and marketing. • Explain digital tools used in timber identification and inventory systems. • Explain timber traceability and documentation systems.	Whiteboard and marker, Projector, charts, textbooks, internet, lecture notes, etc.	• Identify wood species using dichotomous key card system • Carry out a Visit to a timber industry to identify relevant industrial machineries	Guide student to: • Identify wood species using dichotomous key card system • Carry out a Visit to a timber industry to identify relevant industrial machineries	Timber market/sawmill, Hand lens, Timber catalogue, Smartphones, , Practical manual Etc.

COURSE ASSESSMENT

Coursework: 10%
Tests: 10%
Practical: 40%
Examination: 40%
Total: 100%



WOOD CHEMISTRY

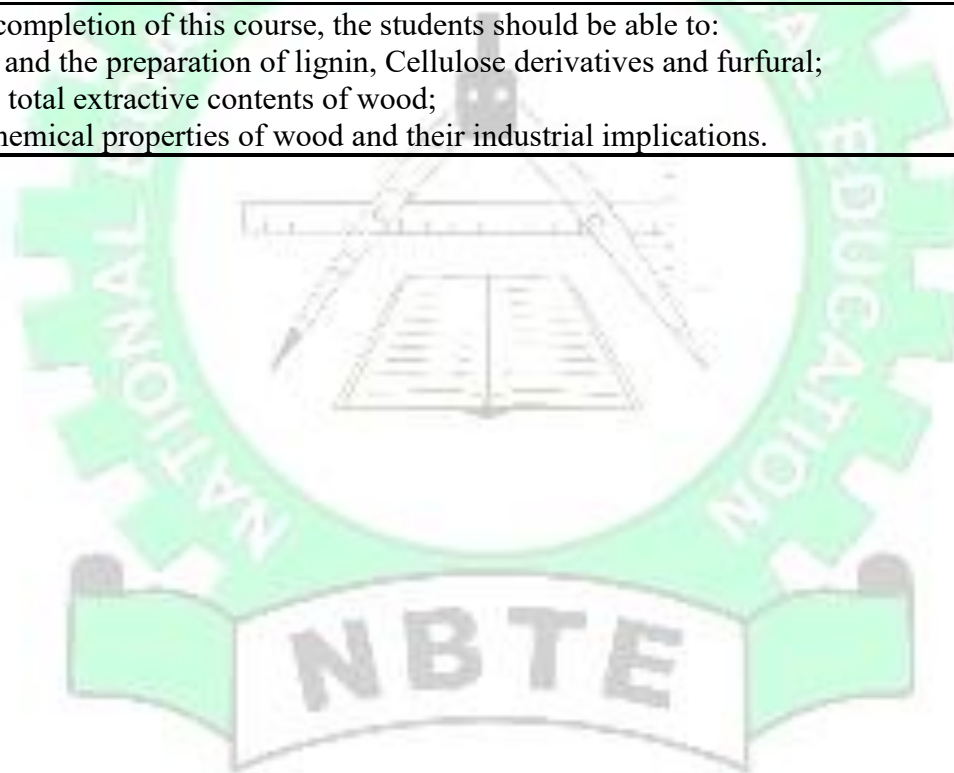
PROGRAMME: HIGHER NATIONAL DIPLOMA WOOD AND PAPER TECHNOLOGY (WOOD PRODUCTS PROCESSING TECHNOLOGY OPTION)

COURSE TITLE: WOOD CHEMISTRY	COURSE CODE: WPT 312	CONTACT HOURS: 3 HOURS/WEEK
	CREDIT UNIT: 3	THEORETICAL: 1HOUR/WEEK
YEAR: 1 SEMESTER:1	PRE-REQUISITE: NIL	PRACTICAL:2 HOURS/WEEK

GOAL: This course is designed to provide students with knowledge and skills in wood chemical composition, properties, and extraction processes.

GENERAL OBJECTIVES: On completion of this course, the students should be able to:

- 1.0 Understand wood components and the preparation of lignin, Cellulose derivatives and furfural;
- 2.0 Know the determination of the total extractive contents of wood;
- 3.0 Understand the physical and chemical properties of wood and their industrial implications.



PROGRAMME: HIGHER NATIONAL DIPLOMA WOOD AND PAPER TECHNOLOGY (WOOD PRODUCTS PROCESSING TECHNOLOGY OPTION)						
COURSE TITLE: WOOD CHEMISTRY			COURSE CODE: WPT 312		CONTACT HOURS: 3HOURS/WEEK	
			CREDIT UNIT: 3		THEORETICAL: 1HOUR/WEEK	
YEAR: 1 SEMESTER:1			PRE-REQUISITE: NIL		PRACTICAL:2 HOURS/WEEK	
COURSE SPECIFICATION: THEORETICAL AND PRACTICAL						
GOAL: This course is designed to provide students with knowledge and skills in wood chemical composition, properties, and extraction processes.						
GENERAL OBJECTIVE 1.0: Understand wood components and the preparation of lignin, cellulose derivatives and furfural						
THEORETICAL CONTENT				PRACTICAL CONTENT		
Week	Specific Learning Outcome	Teacher’s Activities	Resources	Specific Learning Outcome	Teacher’s Activities	Resources
1–5	1.1 List major wood components, 1.2 Describe physical and chemical properties of major wood components in 1.1 above 1.3 Describe isolation of the major wood components listed in 1.1 above 1.4 Describe the derivatives, uses and importance of the components isolated in 1.3 above 1.5 Explain the term Technical Association of the Pulp and Paper Industry (TAPPI)	• State major wood components, e.g. cellulose, hemicellulose, lignin. • Explain physical and chemical properties of major wood components • Explain isolation of the major wood components describe in 1.1 above • Explain the derivatives, uses and importance of the components isolated in 1.3 above • Explain the term TAPPI standard. • Explain the preparation	Whiteboard and marker, Projector, charts, textbooks, internet, lecture notes, etc.	• Isolate the major wood components describe in 1.1 above • Prepare cellulose nitrate, alkali-cellulose • Prepare furfural in the laboratory. • Isolate lignin from wood	Guide student to; • Isolate the major wood components describe in 1.1 above • Prepare cellulose nitrate, alkali- cellulose • Prepare furfural in the laboratory. • Isolate lignin from wood	Wood samples

	standard. 1.6 Describe the preparation of cellulose nitrate, alkali- cellulose 1.7 List the uses of the products in 1.6 above. 1.8 Describe the laboratory preparation of furfural. 1.9 Explain the uses of furfural. 1.10 Describe the preparation of furfural in the laboratory. 1.11 Define lignin. 1.12 Describe lignin from wood 1.13 Describe isolation of lignin from wood	of cellulose nitrate, alkali- cellulose • State the uses of the products in 1.6 above • Explain the laboratory preparation of furfural • Explain the uses of furfural • Explain the preparation of furfural in the laboratory. • Explain lignin • Explain lignin from wood • Explain isolation of lignin from wood				
General Objective 2.0: Know the determination of the total extractive contents of wood						

6-10	2.1 Explain the use of chromatography, thin layer chromatography in the determination of total extractive contents of wood 2.2 Describe determination total extractive contents of wood 2.3 Describe the method of isolation of wood 2.4 Describe minor wood components and reducing sugars.	• Explain the use of chromatography, thin layer chromatography in the determination of total extractive contents of wood • Explain determination total extractive contents of wood • Explain the method of isolation of wood • Explain minor wood components and reducing sugars.	Whiteboard and marker, Projector, charts, textbooks, internet, lecture notes, etc.	• Determine total extractive contents of wood	Guide student to: Determine total extractive contents of wood	Wood samples
General Objective 3.0: Understand the effects of heat, chemicals, light and powerful rays on wood						
11-15	3.1 Describe the reaction of wood when heated at various temperatures. 3.2 Describe preparation of charcoal from wood. 3.3 Describe determination the ash content of charcoal 3.4 Compare the heat values of wood with those of other energy sources. 3.5 Compare the properties of wood to	• Explain the reaction of wood when heated at various temperatures. • Explain preparation of charcoal from wood • Explain determination the ash content of charcoal • Compare the heat values of wood with those of other energy sources. • Compare the properties of wood to those of other construction materials in relation to their respective	Whiteboard and marker, Projector, charts, textbooks, internet, lecture notes, etc.	• Prepare charcoal from wood. • Determine the ash content of charcoal • Compare the heat values of wood with those of other energy sources. • Compare the properties of wood to those of other construction materials in relation to their respective resistance to chemical attack	Guide student to: • Prepare charcoal from wood. • Determine the ash content of charcoal • Compare the heat values of wood with those of other energy sources. • Compare the properties of wood to those of other construction materials in relation to their respective resistance to chemical attack	Wood samples

	those of other construction materials in relation to their respective resistance to chemical attack. 3.6 Describe the effect of light and strong gamma rays on the properties of wood and wood products. 3.7 Explain the concept of fixation of toxic chemical in wood.	resistance to chemical attack • Explain the effect of light and strong gamma rays on the properties of wood and wood products. • Explain the concept of fixation of toxic chemical in wood.				
COURSE ASSESSMENT Coursework: 10% Tests: 10% Practical: 40% Examination: 40% Total: 100%						

WOOD PHYSICS

PROGRAMME: HIGHER NATIONAL DIPLOMA WOOD AND PAPER TECHNOLOGY (WOOD PRODUCTS PROCESSING TECHNOLOGY OPTION)		
COURSE TITLE: WOOD PHYSICS	COURSE CODE: WPT 313	CONTACT HOURS: 3 HOURS/WEEK
	CREDIT UNIT: 3	THEORETICAL: 1 HOUR/WEEK
YEAR: I SEMESTER: I	PRE-REQUISITE: NIL	PRACTICAL: 2 HOURS/WEEK
GOAL: The course is designed to equip students with the knowledge and skills of the physical properties of wood.		
GENERAL OBJECTIVES: On completion of this course, the students should be able to: 1.0 Understand the methods of determination of wood density at various moisture content levels; 2.0 Know the effect of moisture content of wood on its physical properties and usage; 3.0 Know the anisotropic behavior of wood in both aqueous and non-aqueous liquids; 4.0 Understand the process of diffusion in wood and factors affecting it; 5.0 Know the influence of wood structure, density moisture content on thermal conductivity of wood; 6.0 Understand the electrical properties of wood.		

PROGRAMME: HIGHER NATIONAL DIPLOMA WOOD AND PAPER TECHNOLOGY (WOOD PRODUCTS PROCESSING TECHNOLOGY OPTION)

COURSE TITLE: WOOD PHYSICS	COURSE CODE: WPT 313	CONTACT HOURS: 3 HOURS/WEEK
	CREDIT UNIT: 3	THEORETICAL: 1 HOUR/WEEK
YEAR: I SEMESTER: I	PRE-REQUISITE: NIL	PRACTICAL: 2 HOURS/WEEK

COURSE SPECIFICATION: THEORETICAL AND PRACTICAL

GOAL: The course is designed to equip students with the knowledge and skills of the physical properties of wood.

GENERAL OBJECTIVE 1.0: Understand the methods of determination of wood density at various moisture content levels.

THEORETICAL				PRACTICAL CONTENT		
Week	Specific Learning Outcome	Teacher's Activities	Resources	Specific Learning Outcome	Teacher's Activities	Resources
1-3	1.1 Explain wood density types. 1.2 Describe density measurement of irregular wood samples with a Breuil apparatus. 1.3 Describe the effect of moisture content on wood density. 1.4 Explain the green-wood density relationship. 1.5 Explain the calculation of density of green wood.	- Discuss wood density types. - Explain density measurement of irregular wood samples with a Breuil apparatus. - Explain the effect of moisture content on wood density. - Discuss the green-wood density relationship. - Discuss the calculation of	wood physics textbooks, formula sheets, property charts, wood standards, worked examples, computer, projector, internet resources.	- Determine the exact density of irregularly shaped wood sample by immersion in suitable liquid media, using Breuil apparatus. - Calculate the density of green wood. - Demonstrate different types of density of wood. Such as bulk density, packing density, oven dry density etc. - Classify wood	- Determine the exact density of irregularly shaped wood sample by immersion in suitable liquid media, using Breuil apparatus. - Calculate the density of green wood. - Demonstrate different types of density of wood. Such as bulk density, packing density, oven dry density etc. - Classify wood	wood specimens, balance, callipers, moisture meter, oven, Breuil apparatus, electrical test instruments, data sheets, PPE.

		density of green wood.		density types using selected samples. • Test density measurement of irregular wood samples with a Breuil apparatus with appropriate equipment. • Test the effect of moisture content on wood density with appropriate equipment.	density types using selected samples. • Test density measurement of irregular wood samples with a Breuil apparatus with appropriate equipment. • Test the effect of moisture content on wood density with appropriate equipment.	
General Objective 2.0: Know the effect of moisture content of wood on its physical properties and usage.						
4-6	2.1 Explain effects of moisture content on wood properties. 2.2 Explain moisture effects on wood biodeterioration. 2.3 Describe the measurement of moisture content of wood using the hygrometric and electrical methods. 2.4 Describe the thermodynamics of absorption.	• Discuss effects of moisture content on wood properties. • Discuss moisture effects on wood biodeterioration. • Explain the measurement of moisture content of wood using the hygrometric and electrical methods. • Explain the thermodynamics of absorption.	wood physics textbooks, formula sheets, property charts, wood standards, worked examples, computer, projector, internet resources.	• Measure the moisture content of wood using the hygrometric and electrical methods. • Compare the two methods. • Assess the effect of moisture content of wood on its susceptibility to biodeterioration. • Document the thermodynamics of absorption. • Test effects of moisture content on	• Measure the moisture content of wood using the hygrometric and electrical methods. • Compare the two methods. • Assess the effect of moisture content of wood on its susceptibility to biodeterioration. • Document the thermodynamics of absorption.	wood specimens, balance, callipers, moisture meter, oven, Breuil apparatus, electrical test instruments, data sheets, PPE.

				wood properties with appropriate equipment.	Test effects of moisture content on wood properties with appropriate equipment.	
General Objective 3.0: Know the anisotropic behaviour of wood in both aqueous and non-aqueous liquids.						
7-9	3.1 Describe anisotropic swelling and shrinkage of wood. 3.2 Describe components of wood swelling. 3.3 Describe the swelling of wood in aqueous and non-aqueous liquids. 3.4 Explain the dimensional stabilization in wood. 3.5 Describe the effect of restraining the movement of wood during swelling or shrinkage.	- Explain anisotropic swelling and shrinkage of wood. - Explain components of wood swelling. - Explain the swelling of wood in aqueous and non-aqueous liquids. - Discuss the dimensional stabilization in wood. - Explain the effect of restraining the movement of wood during swelling or shrinkage.	wood physics textbooks, formula sheets, property charts, wood standards, worked examples, computer, projector, internet resources.	- Measure radial, tangential and longitudinal swelling and shrinkage of selected wood specimens after exposure to aqueous and non-aqueous liquids. - Calculate percentage dimensional change and the anisotropy ratio for each specimen. - Demonstrate the effect of mechanical restraint and a selected dimensional-stabilisation treatment on wood movement. - Compare the experimental	- Measure radial, tangential and longitudinal swelling and shrinkage of selected wood specimens after exposure to aqueous and non-aqueous liquids. - Calculate percentage dimensional change and the anisotropy ratio for each specimen. - Demonstrate the effect of mechanical restraint and a selected dimensional-stabilisation treatment on wood movement.	wood specimens, balance, callipers, moisture meter, oven, Breuil apparatus, electrical test instruments, data sheets, PPE.

				- results. • Prepare a concise practical report. • Analyse an assigned practical case on anisotropic swelling and shrinkage of wood.	• Compare the experimental results. • Prepare a concise practical report. • Analyse an assigned practical case on anisotropic swelling and shrinkage of wood.	
General Objective 4.0: Understand the process of diffusion in wood and factors affecting it						
10–11	7.3 State the meaning of permeability of wood. 7.4 Describe the diffusion of water in solid wood and its effects on the drying process of wood. 7.5 Describe the non-pressure and pressure aspects of wood impregnation.	• Outline the meaning of permeability of wood. • Explain the diffusion of water in solid wood and its effects on the drying process of wood. • Explain the non-pressure and pressure aspects of wood impregnation.	wood physics textbooks, formula sheets, property charts, wood standards, worked examples, computer, projector, internet resources.	• Prepare a concise illustrated summary of permeability of wood. • Simulate the diffusion of water in solid wood and its effects on the drying process of wood using the approved procedure. • Record observations. • Document the non-pressure and pressure aspects of wood impregnation. • Analyse an assigned practical case on permeability of wood.	• Prepare a concise illustrated summary of permeability of wood. • Simulate the diffusion of water in solid wood and its effects on the drying process of wood using the approved procedure. • Record observations. • Document the non-pressure and pressure	wood specimens, balance, callipers, moisture meter, oven, Breuil apparatus, electrical test instruments, data sheets, PPE.

					aspects of wood impregnation. Analyse an assigned practical case on permeability of wood.	
General Objective 5.0: know the influence of wood structure, density, moisture content on thermal conductivity of wood						
12–13	5.1 Describe the influence of wood structure, density, moisture content and temperature on thermal conductivity of wood. 5.2 State the meaning of thermal diffusivity of wood. 5.3 Explain time-temperature relationship for thermal conductivity of wood using thermal diffusivity. 5.4 Describe the radiation of thermal energy in wood.	- Explain the influence of wood structure, density, moisture content and temperature on thermal conductivity of wood. - Outline the meaning of thermal diffusivity of wood. - Discuss time-temperature relationship for thermal conductivity of wood using thermal diffusivity. - Explain the radiation of thermal energy in wood.	wood physics textbooks, formula sheets, property charts, wood standards, worked examples, computer, projector, internet resources.	- Document the influence of wood structure, density, moisture content and temperature on thermal conductivity of wood. - Document the radiation of thermal energy in wood. - Analyse an assigned practical case on thermal diffusivity of wood. - Test time-temperature relationship for thermal conductivity of wood using thermal diffusivity with appropriate equipment. - Record observations in the practical logbook.	- Document the influence of wood structure, density, moisture content and temperature on thermal conductivity of wood. - Document the radiation of thermal energy in wood. - Analyse an assigned practical case on thermal diffusivity of wood. - Test time-temperature relationship for thermal conductivity of wood using thermal	wood specimens, balance, callipers, moisture meter, oven, Breuil apparatus, electrical test instruments, data sheets, PPE.

					diffusivity with appropriate equipment. Record observations in the practical logbook.	
General Objective 6.0: Understand the electrical properties of wood						
14-15	6.1 Explain the effects of direct current on wood properties. 6.2 Explain the determination of the electrical resistance of wood and hence its conductivity. 6.3 Explain the effects of alternating current on wood properties. 6.4 Describe the resistivity and dielectric properties of wood. 6.5 Explain the method for calculating the radio- frequency rate of drying	- Discuss the effects of direct current on wood properties. - Discuss the determination of the electrical resistance of wood and hence its conductivity. - Discuss the effects of alternating current on wood properties. - Explain the resistivity and dielectric properties of wood. - Discuss the	wood physics textbooks, formula sheets, property charts, wood standards, worked examples, computer, projector, internet resources.	- Determine the electrical resistance of wood and hence its conductivity. - Calculate the radio-frequency rate of drying wood using its dielectric properties. - Analyse supplied data on the effects of direct current on wood properties. - Interpret the findings. - Test the effects of direct current on wood properties with appropriate equipment. • Test the resistivity and dielectric properties of wood with appropriate equipment.	- Determine the electrical resistance of wood and hence its conductivity. - Calculate the radio- frequency rate of drying wood using its dielectric properties. - Analyse supplied data on the effects of direct current on wood properties. - Interpret the findings. - Test the effects of direct current on wood properties with appropriate equipment. • Test the resistivity and	wood specimens, balance, callipers, moisture meter, oven, Breuil apparatus, electrical test instruments, data sheets, PPE.

	wood using its dielectric properties.	method for calculating the radio-frequency rate of drying wood using its dielectric properties.			dielectric properties of wood with appropriate equipment.	
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COURSE ASSESSMENT

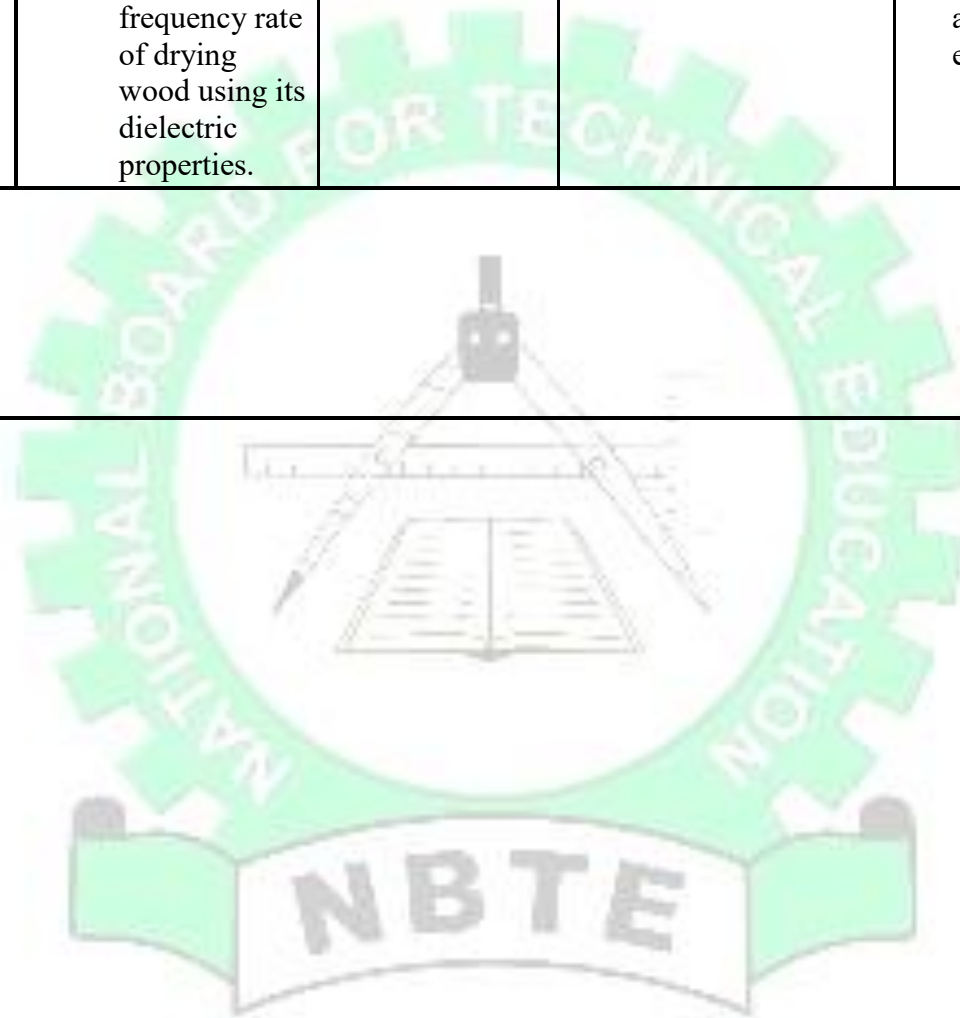
Coursework: 10%

Tests: 10%

Practical: 40%

Examination: 40%

Total: 100%



TIMBER HARVESTING, CONVERSION AND PROCESSING SYSTEM

PROGRAMME: HIGHER NATIONAL DIPLOMA WOOD AND PAPER TECHNOLOGY (WOOD PRODUCTS PROCESSING TECHNOLOGY OPTION)		
COURSE TITLE: TIMBER HARVESTING, CONVERSION AND PROCESSING SYSTEM	COURSE CODE: WPT 314	CONTACT HOURS: 4HOURS/WEEK
	CREDIT UNIT: 4	THEORETICAL: 1HOUR/WEEK
YEAR: 1 SEMESTER:1	PRE-REQUISITE: NIL	PRACTICAL:3 HOURS/WEEK
GOAL: This course is designed to equip students with knowledge and skills in timber harvesting, log conversion, sawmilling operations and timber processing systems.		
GENERAL OBJECTIVES: On completion of this course, the students should be able to: 1.0 Understand timber harvesting systems and operations; 2.0 Understand log handling and transportation systems; 3.0 Understand timber conversion methods and sawmilling processes; 4.0 Understand timber processing systems and machine operations; 5.0 Apply timber harvesting, conversion and processing techniques in industrial operations.		

PROGRAMME: HIGHER NATIONAL DIPLOMA WOOD AND PAPER TECHNOLOGY (WOOD PRODUCTS PROCESSING TECHNOLOGY OPTION)						
COURSE TITLE: TIMBER HARVESTING, CONVERSION AND PROCESSING SYSTEM		COURSE CODE: WPT 314		CONTACT HOURS: 4HOURS/WEEK		
		CREDIT UNIT: 4		THEORETICAL: 1HOUR/WEEK		
YEAR: I SEMESTER: I		PRE-REQUISITE: NIL		PRACTICAL: 3HOURS/WEEK		
COURSE SPECIFICATION: THEORETICAL AND PRACTICAL						
GOAL: This course is designed to equip students with advanced knowledge and practical competencies in timber harvesting, log conversion, sawmilling operations and timber processing system.						
GENERAL OBJECTIVE 1.0: Understand timber harvesting systems and operations						
THEORETICAL CONTENT				PRACTICAL CONTENT		
Week	Specific Learning Outcome	Teacher’s Activities	Resources	Specific Learning Outcome	Teacher’s Activities	Resources
1–3	1.1 Explain timber harvesting systems and operations. 1.2 Describe stages of timber harvesting 1.3 Explain manual and mechanized harvesting methods. 1.4 Describe environmental and safety considerations in timber harvesting. 1.5 Explain sustainable timber harvesting principles.	- Describe timber harvesting systems and operations. - Explain stages of timber harvesting - Discuss manual and mechanized harvesting methods. - Explain environmental and safety considerations in timber harvesting. - Discuss sustainable timber harvesting principles.	Harvesting charts, logging videos, timber harvesting manuals, projector, textbooks etc.	- Identify timber harvesting tools and equipment. - Demonstrate safe handling of hand tools used in timber harvesting. - Observe tree felling techniques through field demonstration/video and record stages. - Prepare harvesting operation report.	Guide students to: - Identify timber harvesting tools and equipment. - Demonstrate safe handling of hand tools used in timber harvesting. - Observe tree felling techniques through field demonstration/video and record stages. - Prepare harvesting operation report.	Harvesting tools, PPE, Videos, Field Practical manual.
General Objective 2.0: Understand log handling and transportation systems						

4–5	2.1 Describe log handling methods after harvesting. 2.2 Explain log extraction systems: skidding, hauling and loading. 2.3 Explain log storage and preservation during transportation. 2.4 Describe factors affecting log quality during handling and transportation.	• Explain log handling methods after harvesting. • Discuss log extraction systems: skidding, hauling and loading. • Describe log storage and preservation during transportation. • Discuss factors affecting log quality during handling and transportation.	Log handling charts, transportation videos, Timber samples, Projector, Textbooks etc.	• Measure log dimensions • Estimate log volume. • Identify log defects associated with poor handling and transportation. • Compare properly handled and poorly handled timber logs.	Guide student to: • Measure log dimensions • Estimate log volume. • Identify log defects associated with poor handling and transportation. • Compare properly handled and poorly handled timber logs.	Timber logs, Measuring tape, Log scale, calculator, , practical manual.
General Objective 3.0: Understand timber conversion methods and sawmilling processes						
6–9	3.1 Explain timber conversion methods 3.2 Describe sawmilling processes and workflow. 3.3 Explain types of saws used in timber conversion. 3.4 Describe timber recovery and conversion efficiency. 3.5 Explain causes of conversion defects and waste generation	• Discuss timber conversion methods: • Explain sawmilling processes and workflow. • Discuss types of saws used in timber conversion. • Explain timber recovery and conversion efficiency. • Discuss causes of conversion defects and waste generation.	Sawmill videos, Timber conversion charts, Timber specimens, Projector, Textbooks Etc.	• Identify sawmill machines and saw types. • Demonstrate timber conversion patterns using timber blocks. • Calculate timber recovery percentage from processed timber. • Identify defects arising during timber conversion.	Guide student to: • Identify sawmill machines and saw types • Demonstrate timber conversion patterns using timber blocks. • Calculate timber recovery percentage	Timber blocks, Sawmill Layout charts, Measuring tape, Calculators, Practical manual

					from processed timber. • Identify defects arising during timber conversion.	
General Objective 4.0: Understand timber processing systems and machine operations						
10–12	4.1 Explain timber processing systems in wood industries. 4.2 Describe timber processing machines and their functions. 4.3 Explain machine operation principles and maintenance requirements. 4.4 Describe safety precautions in timber processing operations.	• Discuss timber processing systems in wood industries. • Discuss timber processing machines and their functions. • Discuss machine operation principles and maintenance requirements • Explain safety precautions in timber processing operations.	Workshop machines, Processing charts, Maintenance manuals, projector, Textbooks Etc.	• Identify timber processing machines and their components. • Demonstrate safe operation of selected workshop machines. • Observe machine maintenance procedures. • Prepare machine operation checklist.	Guide students to: • Identify timber processing machines and their components. • Demonstrate safe operation of selected workshop machines. • Observe machine maintenance procedures. • Prepare machine operation checklist.	Timber blocks, Sawmill Layout charts, Measuring tape, Calculators, Practical manual
General Objective 5.0: Apply timber harvesting, conversion and processing techniques in industrial operations						
13–15	5.1 Describe industrial timber processing workflow. 5.2 Explain quality considerations in	• Explain industrial timber processing workflow. • Describe quality considerations in	Industrial processing charts, Sawmill videos,	• Visit sawmill or timber processing industry and • Observe harvesting-to-	Guide students to: • Visit sawmill or timber processing industry and • Observe	Sawmill/timber processing facility, Measuring tape,

	timber harvesting and processing. 5.3 Describe timber waste reduction practices. 5.4 Explain emerging trends in timber harvesting and processing systems.	timber harvesting and processing. • Explain timber waste reduction practices. • Discuss emerging trends in timber harvesting and processing systems.	Projector, Textbooks Etc.	processing workflow. • Measure processed timber • Estimate recovery efficiency. • Assess timber quality and identify processing defects	harvesting-to-processing workflow. • Measure processed timber • Estimate recovery efficiency. • Assess timber quality and identify processing defects	Calculator, t, Practical manual.
COURSE ASSESSMENT Coursework: 10% Tests: 10% Practical: 40% Examination: 40% Total: 100%						

WOOD SEASONING

PROGRAMME: HIGHER NATIONAL DIPLOMA WOOD AND PAPER TECHNOLOGY (WOOD PRODUCTS PROCESSING TECHNOLOGY OPTION)		
COURSE TITLE: WOOD SEASONING	COURSE CODE: WPT 315	CONTACT HOURS: 4 HOURS/WEEK
	CREDIT UNIT: 4	THEORETICAL: 1HOUR/WEEK
YEAR: I SEMESTER: I	PRE-REQUISITE: NIL	PRACTICAL: 3 HOURS/WEEK
GOAL: This course is designed to equip students with knowledge and skills of principles and techniques of wood seasoning.		
GENERAL OBJECTIVES: On completion of this course, the students should be able to: 1.0 Understand the theory of wood seasoning; 2.0 Understand the principles and techniques of various wood seasoning methods; 3.0 Know the different methods of veneer drying.		

PROGRAMME: HIGHER NATIONAL DIPLOMA WOOD AND PAPER TECHNOLOGY (WOOD PRODUCTS PROCESSING TECHNOLOGY OPTION)

COURSE TITLE: WOOD SEASONING	COURSE CODE: WPT 315	CONTACT HOURS: 4 HOURS/WEEK
	CREDIT UNIT: 4	THEORETICAL: 1HOUR/WEEK
YEAR: I SEMESTER: I	PRE-REQUISITE: NIL	PRACTICAL: 3 HOURS/WEEK

COURSE SPECIFICATION: THEORETICAL AND PRACTICAL**GOAL:** This course is designed to provide students with the knowledge and skills of principles and techniques of wood seasoning.**GENERAL OBJECTIVE 1.0:** Understand the theory of wood seasoning

THEORETICAL				PRACTICAL CONTENT		
Week	Specific Learning Outcome	Teacher's Activities	Resources	Specific Learning Outcome	Teacher's Activities	Resources
1-4	1.1 Explain seasoning to include moisture content reduction and minimizing drying defects. 1.2 Explain moisture content of wood 1.3 Describe Equilibrium Moisture Content (EMC) distribution in Nigeria. 1.4 Explain moisture gradient mathematically and its effects on the rate of drying.	• Discuss seasoning to include moisture content reduction and minimizing drying defects using relevant examples, diagrams and illustrations. • Discuss moisture content of wood • Explain Equilibrium Moisture Content (EMC) distribution in Nigeria using relevant examples, diagrams and illustrations. • Discuss moisture gradient mathematically and its effects on the rate of	wood-seasoning textbooks, kiln diagrams, psychrometric charts, drying schedules, technical standards, computer, projector, internet resources.	• Determine the initial and final moisture content of wood specimens using oven-dry and electrical moisture-meter methods. • Calculate moisture loss, moisture gradient and equilibrium moisture content from supplied temperature and relative-humidity data. • Inspect the	Guide students to: • Determine the initial and final moisture content of wood specimens using oven-dry and electrical moisture-meter methods. • Calculate moisture loss, moisture gradient and equilibrium moisture content from supplied temperature and relative-humidity data. • Inspect the seasoned specimens	wood specimens, drying oven, moisture meter, kiln or kiln model, thermometers, hygrometer, psychrometric chart, data sheets, PPE.

		drying using relevant examples, diagrams and illustrations.		seasoned specimens • Identify drying defects and recommend corrective measures.	• Identify drying defects and recommend corrective measures.	
General Objective 2.0: Understand the principles and techniques of various wood seasoning methods						
5-10	2.1 Describe the major wood seasoning methods 2.2 Outline air-seasoning yard layout requirements for efficient drying. 2.3 Describe conventional and accelerated air-drying methods. 2.4 Explain kiln types, design features, instrumentation and operating controls. 2.5 Describe the effects of temperature, relative humidity, air circulation and steaming on kiln drying. 2.6 Explain drying	• Explain the major wood seasoning methods • Explain air-seasoning yard layout, foundation, stacking and ventilation requirements for efficient drying • Discuss conventional and accelerated air-drying methods. • Discuss kiln types, kiln design features, instrumentation and operating controls • Explain the analytical procedure and interpretation of the effects of temperature, relative humidity, air circulation and steaming on kiln drying using worked • Explain the analytical	wood-seasoning textbooks, kiln diagrams, psychrometric charts, drying schedules, technical standards, computer, projector, internet resources.	• Prepare a scaled layout of an air-seasoning yard showing foundations, stacks, spacing, drainage and access routes. • Arrange a timber stack using correct foundations, stickers, restraints and ventilation provisions. • Operate a kiln-drying cycle using an approved drying schedule and record temperature, humidity and moisture-content	Guide students to: • Prepare a scaled layout of an air-seasoning yard showing foundations, stacks, spacing, drainage and access routes. • Arrange a timber stack using correct foundations, stickers, restraints and ventilation provisions. • Operate a kiln-drying cycle using an approved drying schedule and record temperature, humidity and moisture-content readings.	wood specimens, drying oven, moisture meter, kiln or kiln model, thermometers, hygrometer, psychrometric chart, data sheets, PPE.

	progress using sample weighing, automatic controls, time controllers and drying schedules. 2.7 Describe alternative seasoning methods.	procedure and interpretation of drying progress. • Discuss the criteria and evidence required to evaluate alternative seasoning methods		readings. • Plot drying progress from recorded data • Identify deviations from the selected drying schedule. • Compare kiln, solar, dehumidification and radio-frequency drying methods using specified performance criteria.	• Plot drying progress from recorded data • Identify deviations from the selected drying schedule. • Compare kiln, solar, dehumidification and radio-frequency drying methods using specified performance criteria.	
General Objective 3.0: Know the different methods of veneer drying.						
11-15	3.1 Outline different joints made with adhesives, bolts, screws and gusset plates. 3.2 Explain the principle of veneer drying. 3.3 Explain veneer quality control during drying. 3.4 Describe the methods of veneer drying 3.5 Explain	• Explain different joints made with adhesives, bolts, screws and gusset plates with relevant examples, diagrams or case materials. • Discuss the principle of veneer drying using relevant examples, diagrams and illustrations. • Discuss veneer quality control during drying	wood-seasoning textbooks, kiln diagrams, psychrometric charts, drying schedules, technical standards, computer, projector, internet resources.	• Draw different joints made with adhesives, bolts, screws and gusset plates. • Calculate conventional veneer drying time. • Dry veneer applying any of the methods already described. • Demonstrate or	Guide students to: • Draw different joints made with adhesives, bolts, screws and gusset plates. • Calculate conventional veneer drying time. • Dry veneer applying any of the methods already described. • Demonstrate or	wood specimens, drying oven, moisture meter, kiln or kiln model, thermometers, hygrometer, psychrometric chart, data sheets, PPE.

	conventional veneer drying time.	• Discuss the methods of veneer drying • Discuss conventional veneer drying time.		model the principle of veneer drying through an assigned practical exercise. • Demonstrate or model veneer quality control during drying through an assigned practical exercise.	model the principle of veneer drying through an assigned practical exercise. • Demonstrate or model veneer quality control during drying through an assigned practical exercise.	
COURSE ASSESSMENT Coursework: 10% Tests: 10% Practical: 40% Examination: 40% Total: 100%						

COMPUTER APPLICATIONS IN WOOD AND PAPER TECHNOLOGY

PROGRAMME: HIGHER NATIONAL DIPLOMA WOOD AND PAPER TECHNOLOGY (WOOD PRODUCTS PROCESSING TECHNOLOGY OPTION)		
COURSE TITLE: COMPUTER APPLICATIONS IN WOOD AND PAPER TECHNOLOGY	COURSE CODE: WPT 316	CONTACT HOURS: 4 HOURS/WEEK
	CREDIT UNIT: 4	THEORETICAL: 1HOUR/WEEK
YEAR: I SEMESTER: I	PRE-REQUISITE: NIL	PRACTICAL: 3 HOURS/WEEK
GOAL: This course is designed to equip students with knowledge and skills in computer applications, digital tools and information systems relevant to wood and paper technology.		
GENERAL OBJECTIVES: On completion of this course, the students should be able to: 1.0 Understand computer applications in wood and paper technology; 2.0 Know computer tools for timber calculations and data management; 3.0 Know digital tools for wood products design and documentation; 4.0 Know computer applications in production, inventory and industrial operations.		

PROGRAMME: HIGHER NATIONAL DIPLOMA WOOD AND PAPER TECHNOLOGY (WOOD PRODUCTS PROCESSING TECHNOLOGY OPTION)

COURSE TITLE: COMPUTER APPLICATIONS IN WOOD AND PAPER TECHNOLOGY	COURSE CODE: WPT 316	CONTACT HOURS: 4 HOURS/WEEK
	CREDIT UNIT: 4	THEORETICAL: 1HOUR/WEEK
YEAR: I SEMESTER: I	PRE-REQUISITE: NIL	PRACTICAL: 3 HOURS/WEEK

COURSE SPECIFICATION: THEORETICAL AND PRACTICAL

GOAL: This course is designed to equip students with knowledge and skills in computer applications, digital tools and information systems relevant to wood and paper technology.

GENERAL OBJECTIVE 1.0: Understand computer applications in wood and paper technology;

THEORETICAL				PRACTICAL CONTENT		
Week	Specific Learning Outcome	Teacher's Activities	Resources	Specific Learning Outcome	Teacher's Activities	Resources
1–3	1.1 Explain the role of computers in wood and paper industries. 1.2 Describe computer applications in timber processing, inventory, production and quality control. 1.3 Describe digital information systems used in wood industries. 1.4 Explain the importance of ICT in industrial operations and reporting.	• Discuss the role of computers in wood and paper industries • Explain computer applications in timber processing, inventory, production and quality control • Discuss digital information systems used in wood industries • Discuss the importance of ICT in industrial operations and reporting.	computer systems, application-software manuals, sample datasets, digital templates, projector, computer, internet resources.	• Identify hardware and software used in wood industries • Access online timber information databases and digital catalogues. • Demonstrate or model the role of computers in wood and paper industries through an assigned practical exercise. • Demonstrate computer applications in timber processing,	Guide students to: • Identify hardware and software used in wood industries • Access online timber information databases and digital catalogues. • Demonstrate or model the role of computers in wood and	computers, spreadsheet software, CAD or drawing software, database software, sample production data, printer.

				inventory, production and quality control.	paper industries through an assigned practical exercise. • Demonstrate computer applications in timber processing, inventory, production and quality control.	
General Objective 2.0: Know computer tools for timber calculations and data management						
4–7	2.1 Describe computer applications in timber volume 2.2 Explain spreadsheet functions for timber measurement and costing. 2.3 Describe digital record keeping and database management. 2.4 Explain computer applications in timber inventory management.	• Explain computer applications in timber volume • Discuss spreadsheet functions for timber measurement and costing. • Explain digital record keeping and database management using relevant examples, diagrams and illustrations. • Discuss computer applications in timber inventory management using relevant	computer systems, application-software manuals, sample datasets, digital templates, projector, computer, internet resources.	• Use spreadsheet software to calculate timber volume and recovery percentage. • Prepare timber costing sheet using spreadsheet formulas. • Develop digital timber inventory records. • Prepare timber production data and summary report.	Guide students to: • Use spreadsheet software to calculate timber volume and recovery percentage. • Prepare timber costing sheet using spreadsheet formulas. • Develop digital timber inventory records. • Prepare timber production data and summary	computers, spreadsheet software, CAD or drawing software, database software, sample production data, printer.

		examples, diagrams and illustrations.			report.	
General Objective 3.0: Know digital tools for wood product design and documentation						
8–11	3.1 Explain computer applications in wood product design and drafting. 3.2 Describe basic computer-aided design (CAD) concepts in wood industries. 3.3 Explain digital documentation procedures for production and quality control. 3.4 Explain digital communication tools used in wood industries.	• Discuss computer applications in wood product design and drafting • Explain basic computer-aided design (CAD) concepts in wood industries. • Discuss digital documentation procedures for production and quality control. • Discuss digital communication tools used in wood industries.	computer systems, application-software manuals, sample datasets, digital templates, projector, computer, internet resources.	• Prepare simple wood product sketches using computer drawing tools. • Develop digital production report for wood processing operation. • Prepare digital quality inspection checklist. • Design simple timber documentation template.	Guide students to: • Prepare simple wood product sketches using computer drawing tools. • Develop digital production report for wood processing operation. • Prepare digital quality inspection checklist. • Design simple timber documentation template.	computers, spreadsheet software, CAD or drawing software, database software, sample production data, printer.
General Objective 4.0: : Know computer applications in production, inventory and industrial operations						

12-15	4.1 Explain computer applications in production planning and monitoring. 4.2 Describe digital inventory systems in wood industries. 4.3 Explain computer applications in quality assurance and industrial reporting. 4.4 Describe emerging digital trends in wood and paper industries.	• Discuss computer applications in production planning and monitoring. • Discuss digital inventory systems in wood industries. • Describe s computer applications in quality assurance and industrial reporting. • Discuss emerging digital trends in wood and paper industries.	computer systems, application- software manuals, sample datasets, digital templates, projector, computer, internet resources.	• Prepare digital production schedule for timber processing. Develop computerized inventory system for timber products. • Visit sawmill or furniture workshop and assess digital record systems used. • Demonstrate or model computer applications in production planning and monitoring through an assigned practical exercise. • Use relevant software or digital tools to demonstrate digital inventory systems in wood industries and present the output.	Guide students to: • Prepare digital production schedule for timber processing. Develop computerized inventory system for timber products. • Visit sawmill or furniture workshop and assess digital record systems used. • Demonstrate or model computer applications in production planning and monitoring • Use relevant software or digital tools to demonstrate digital inventory systems in wood industries.	computers, spreadsheet software, CAD or drawing software, database software, sample production data, printer.
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COURSE ASSESSMENT**Coursework: 10%****Tests: 10%**

Practical:	40%
Examination:	40%
Total:	100%



INDUSTRIAL SAFETY, HEALTH AND ENVIRONMENTAL MANAGEMENT

PROGRAMME: HIGHER NATIONAL DIPLOMA WOOD AND PAPER TECHNOLOGY (WOOD PRODUCTS PROCESSING TECHNOLOGY OPTION)		
COURSE TITLE: INDUSTRIAL SAFETY, HEALTH AND ENVIRONMENTAL MANAGEMENT	COURSE CODE: WPT 317	CONTACT HOURS: 3 HOURS/WEEK
	CREDIT UNIT: 3	THEORETICAL: 1HOUR/WEEK
YEAR: I SEMESTER: I	PRE-REQUISITE: NIL	PRACTICAL: 2 HOURS/WEEK
GOAL: This course is designed to equip students with knowledge and practical competencies in industrial safety, occupational health and environmental management practices for safe operations in wood and paper industries.		
GENERAL OBJECTIVES: On completion of this course, the students should be able to: 1.0 Understand principles of industrial safety and occupational health; 2.0 Know workshop and machine safety practices; 3.0 Know accident prevention, emergency response and fire safety protocols; 4.0 Understand environmental management practices in wood and paper industries.		

PROGRAMME: HIGHER NATIONAL DIPLOMA WOOD AND PAPER TECHNOLOGY (WOOD PRODUCTS PROCESSING TECHNOLOGY OPTION)

COURSE TITLE: INDUSTRIAL SAFETY, HEALTH AND ENVIRONMENTAL MANAGEMENT	COURSE CODE: WPT 317	CONTACT HOURS: 3 HOURS/WEEK
	CREDIT UNIT: 3	THEORETICAL: 1HOUR/WEEK
YEAR: I SEMESTER: I	PRE-REQUISITE: NIL	PRACTICAL: 2 HOURS/WEEK

COURSE SPECIFICATION: THEORETICAL AND PRACTICAL

GOAL: This course is designed to equip students with knowledge and practical competencies in industrial safety, occupational health and environmental management practices for safe operations in wood and paper industries.

GENERAL OBJECTIVE 1.0: Understand principles of industrial safety and occupational health

THEORETICAL				PRACTICAL CONTENT		
Week	Specific Learning Outcome	Teacher's Activities	Resources	Specific Learning Outcome	Teacher's Activities	Resources
1–3	1.1 Explain principles of industrial safety and occupational health. 1.2 Describe workplace hazards in wood and paper industries. 1.3 Explain causes and effects of workplace accidents. 1.4 Explain occupational health hazards associated with wood dust, chemicals, noise and machine operations. 1.5 Explain safety signs and regulations in industrial	• Discuss principles of industrial safety and occupational health. • Explain workplace hazards in wood and paper industries. • Discuss causes and effects of workplace accidents. • Discuss occupational health hazards associated with wood dust, chemicals, noise and machine operations. • Discuss safety signs and regulations in	occupational-safety legislation, safety manuals, hazard charts, risk-assessment templates, case studies, computer, projector, internet resources.	• Identify workplace hazards from workshop/sawmill settings. • Interpret industrial safety signs and symbols. • Prepare workplace hazard checklist for wood workshop. • Demonstrate principles of industrial safety and occupational health through an assigned practical exercise.	Guide students to: • Identify workplace hazards from workshop/sawmill settings. • Interpret industrial safety signs and symbols. • Prepare workplace hazard checklist for wood workshop. • Demonstrate principles of industrial safety and occupational health through an assigned practical	PPE, fire extinguishers, first-aid kit, hazard labels, risk-assessment forms, emergency checklist.

	environments.	industrial environments.			exercise.	
General Objective 2.0: Know workshop and machine safety practices						
4-7	2.1 Explain workshop safety rules and regulations. 2.2 Explain machine safety requirements in wood industries. 2.3 Explain personal protective equipment (PPE) and their uses. 2.4 Explain safe handling of chemicals and hazardous materials.	• Discuss workshop safety rules and regulations using relevant examples, diagrams and illustrations. • Discuss machine safety requirements in wood industries using relevant examples, diagrams and illustrations. • Discuss personal protective equipment (PPE) and their uses using relevant examples, diagrams and illustrations. • Discuss safe handling of chemicals and hazardous materials using relevant examples, diagrams and illustrations.	occupational-safety legislation, safety manuals, hazard charts, risk-assessment templates, case studies, computer, projector, internet resources.	• Use PPE correctly. • Conduct workshop safety inspection using checklist. • Demonstrate safe machine handling procedures. • Demonstrate or model workshop safety rules and regulations through an assigned practical exercise.	Guide students to: • Use PPE correctly. • Conduct workshop safety inspection using checklist. • Demonstrate safe machine handling procedures. • Demonstrate or model workshop safety rules and regulations through an assigned practical exercise.	PPE, fire extinguishers, first-aid kit, hazard labels, risk-assessment forms, emergency checklist.
General Objective 3.0: Know accident prevention, emergency response and fire safety						
8-11	3.1 Explain causes and prevention of industrial	• Discuss causes and prevention of industrial accidents	occupational-safety legislation,	• Demonstrate use of fire extinguisher. • Conduct emergency	Guide students to: • Demonstrate use of fire extinguisher.	PPE, fire extinguishers, first-aid kit,

	accidents. 3.2 Describe emergency response procedures in industrial settings. 3.3 Describe fire hazards and fire prevention methods. 3.4 Describe accident reporting procedures and first aid principles.	using relevant examples, diagrams and illustrations. • Discuss emergency response procedures in industrial settings using relevant examples, diagrams and illustrations. • Discuss fire hazards and fire prevention methods using relevant examples, diagrams and illustrations. • Explain accident reporting procedures and first aid principles using relevant examples, diagrams and illustrations.	safety manuals, hazard charts, risk-assessment templates, case studies, computer, projector, internet resources.	evacuation drill. • Simulate workplace accident reporting exercise. • Demonstrate basic first aid procedures.	• Conduct emergency evacuation drill. • Simulate workplace accident reporting exercise. • Demonstrate basic first aid procedures.	hazard labels, risk-assessment forms, emergency checklist.
General Objective 4.0: Understand environmental management practices in wood and paper industries.						
12-15	4.1 Explain environmental issues associated with wood and paper industries. 4.2 Explain wood waste management practices. 4.3 Explain pollution prevention and control measures.	• Discuss environmental issues associated with wood and paper industries using relevant examples, diagrams and illustrations. • Discuss wood waste management practices using	occupational-safety legislation, safety manuals, hazard charts, risk-assessment templates, case studies, computer, projector,	• Identify environmental hazards in workshop/sawmill settings. • Conduct environmental audit using checklist. • Classify wood waste for recycling or reuse. • Demonstrate	Guide students to: • Identify environmental hazards in workshop/sawmill settings. • Conduct environmental audit using checklist.	PPE, fire extinguishers, first-aid kit, hazard labels, risk-assessment forms, emergency checklist.

	4.4 Explain environmental sustainability and regulatory compliance. 4.5 Explain emerging trends in industrial safety and environmental management.	relevant examples, diagrams and illustrations. • Discuss pollution prevention and control measures using relevant examples, diagrams and illustrations. • Discuss environmental sustainability and regulatory compliance using relevant examples, diagrams and illustrations. • Discuss emerging trends in industrial safety and environmental management using relevant examples, diagrams and illustrations.	internet resources.	environmental issues associated with wood and paper industries through an assigned practical exercise.	• Classify wood waste for recycling or reuse. • Demonstrate environmental issues associated with wood and paper industries through an assigned practical exercise.	
COURSE ASSESSMENT Coursework: 10% Tests: 10% Practical: 40% Examination: 40% Total: 100%						

CLIMATE CHANGE AND FOREST RESOURCES

PROGRAMME: HIGHER NATIONAL DIPLOMA WOOD AND PAPER TECHNOLOGY (WOOD PRODUCTS PROCESSING TECHNOLOGY OPTION)		
COURSE TITLE: CLIMATE CHANGE AND FOREST RESOURCES	COURSE CODE: WPT 318	CONTACT HOURS: 2 HOURS/WEEK
	CREDIT UNIT: 2	THEORETICAL: 1HOUR/WEEK
YEAR: 1 SEMESTER: I	PRE-REQUISITE: NIL	PRACTICAL: 1 HOUR/WEEK
GOAL: This course is designed to provide students with comprehensive knowledge and practical skills on climate change, forest ecosystem, sustainable forest resource management, environmental conservation, carbon sequestration and climate adaption strategies.		
GENERAL OBJECTIVES: On completion of this course, the students should be able to: 1.0 Understand the concept, causes and effects of climate change and global warming; 2.0 Know the relationship between forests, biodiversity, and climate regulation; 3.0 Understand deforestation, forest degradation, and sustainable forest management practices; 4.0 Understand carbon sequestration, climate mitigation, and adaptation strategies in forestry.		

PROGRAMME: HIGHER NATIONAL DIPLOMA WOOD AND PAPER TECHNOLOGY (WOOD PRODUCTS PROCESSING TECHNOLOGY OPTION)

COURSE TITLE: CLIMATE CHANGE AND FOREST RESOURCES	COURSE CODE: WPT 318	CONTACT HOURS: 2 HOURS/WEEK
	CREDIT UNIT: 2	THEORETICAL: 1HOUR/WEEK
YEAR: I SEMESTER: I	PRE-REQUISITE: NIL	PRACTICAL: 1 HOUR/WEEK

COURSE SPECIFICATION: THEORETICAL AND PRACTICAL

GOAL: This course is designed to equip students with comprehensive knowledge and practical skills on climate change, forest ecosystem, sustainable forest resource management, environmental conservation, carbon sequestration and climate adaption strategies.

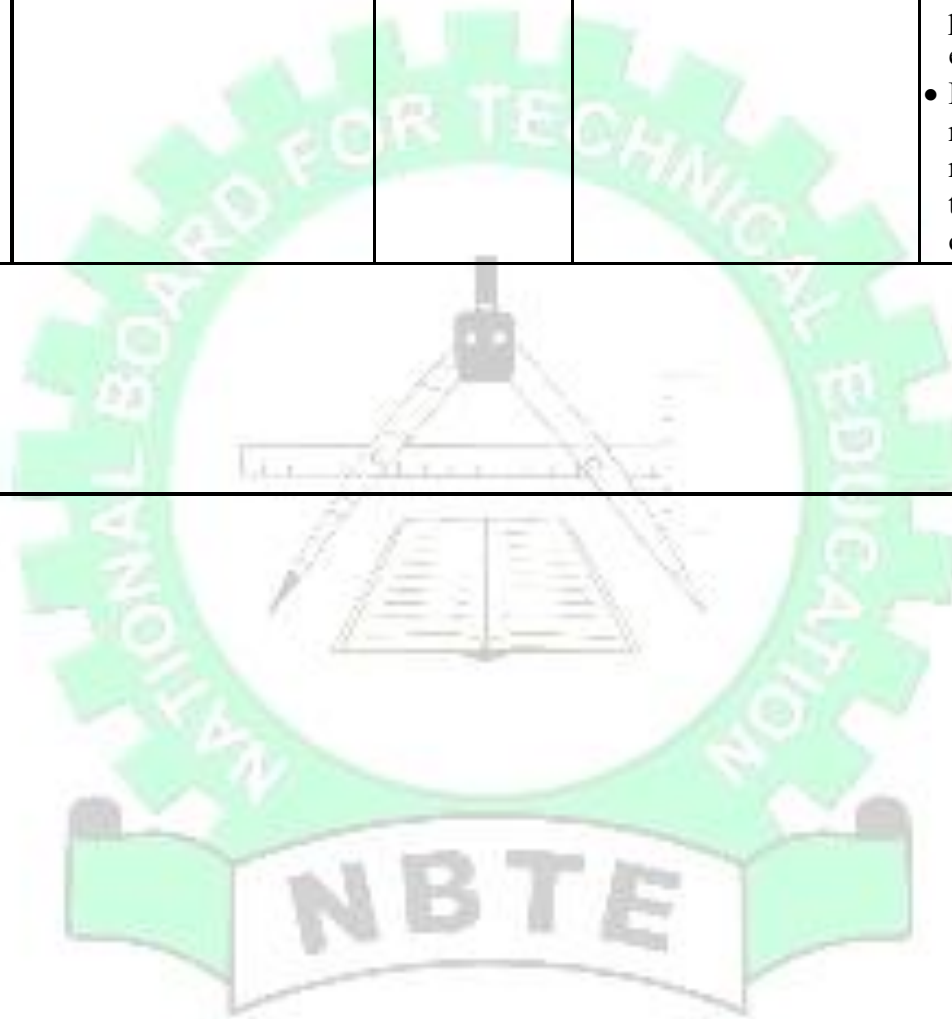
GENERAL OBJECTIVE 1.0: Understand the concept, causes and effects of climate change and global warming.

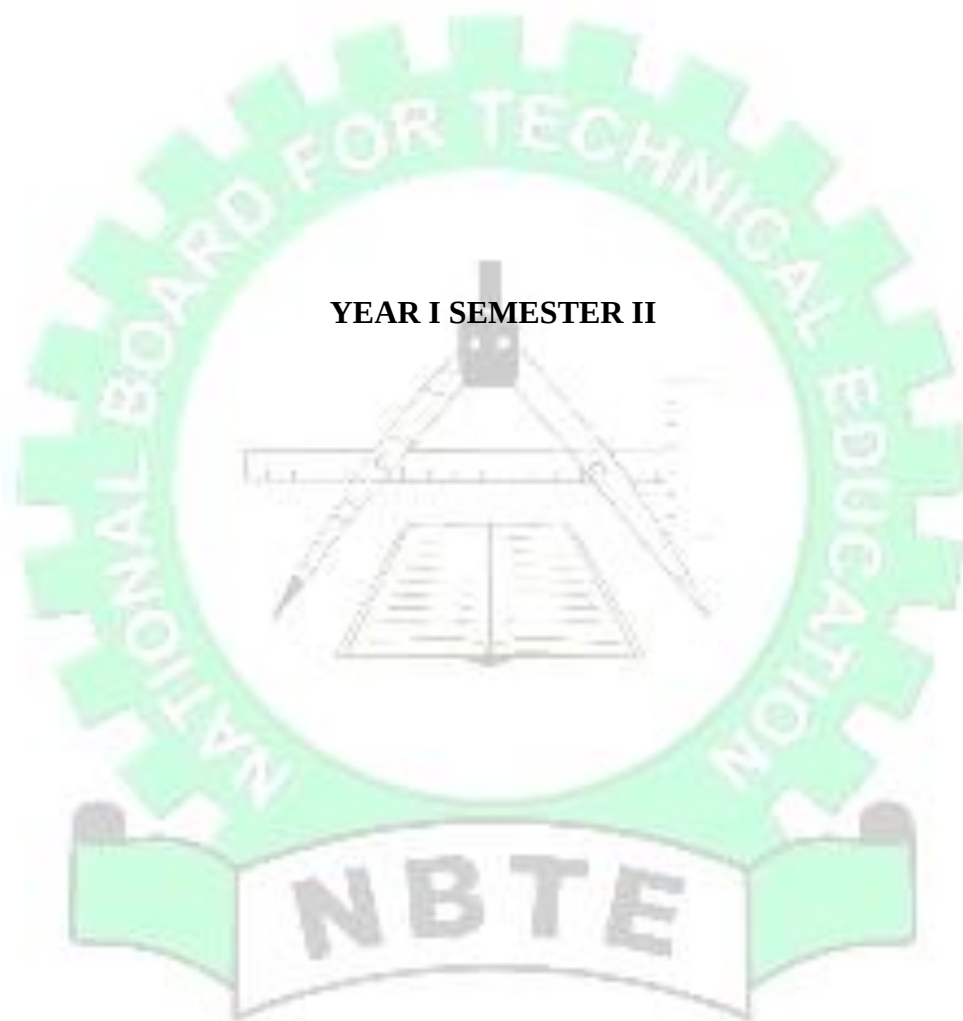
THEORETICAL				PRACTICAL CONTENT		
Week	Specific Learning Outcome	Teacher's Activities	Resources	Specific Learning Outcome	Teacher's Activities	Resources
1-3	1.1 Explain climate change and global warming. 1.2 Describe causes of climate change. 1.3 Explain effects of climate change on forests. 1.4 Explain impacts on forestry and wood industries.	• Discuss climate change and global warming. • Explain causes of climate change • Discuss effects of climate change on forests. • Discuss impacts on forestry and wood industries.	climate-change reports, climate datasets, forest maps, GIS illustrations, case studies, computer, projector, internet resources.	• Observe environmental indicators of climate change. • Create presentation slides on climate change and global warming through an assigned practical exercise. • Identify causes of climate change using the specified criteria. • Conduct a practical investigation of effects of climate change on forests • Interpret the observed results.	Guide students to: • Observe environmental indicators of climate change. • Create presentation slides on climate change and global warming through an assigned practical exercise. • Identify causes of climate change using the specified criteria. • Conduct a practical	computer, climate datasets, maps, GIS software, carbon calculator, field sheets, GPS device.

					investigation of effects of climate change on forests	
General Objective 2.0: Know the relationship between forests, biodiversity, and climate regulation.						
4-7	2.1 Explain forest ecosystem functions. 2.2 Describe species diversity and conservation methods. 2.3 Explain the role of forests in climate regulation. 2.4 Describe rainfall and temperature regulation.	• Discuss forest ecosystem functions. • Discuss species diversity and conservation methods. • Describe the role of forests in climate regulation • Discuss rainfall and temperature regulation using relevant	climate-change reports, climate datasets, forest maps, GIS illustrations, case studies, computer, projector, internet resources.	• Demonstrate forest ecosystem functions through an assigned practical exercise. • Identify species diversity and conservation methods through an assigned practical exercise. • Demonstrate the role of forests in climate regulation through an assigned practical exercise.	Guide students to: • Demonstrate forest ecosystem functions through an assigned practical exercise. • Identify species diversity and conservation methods through an assigned practical exercise. • Demonstrate the role of forests in climate regulation through an assigned practical exercise.	computer, climate datasets, maps, GIS software, carbon calculator, field sheets, GPS device.
General Objective 3.0: Understand deforestation, forest degradation, and sustainable forest management practices.						
8-11	3.1 Explain causes of deforestation. 3.2 Describe effects of forest degradation. 3.3 Explain environmental and economic	• Discuss causes of deforestation. • Explain effects of forest degradation • Discuss environmental and economic impacts of deforestation • Discuss sustainable	climate-change reports, climate datasets, forest maps, GIS illustrations,	• Identify causes of deforestation through an assigned practical exercise. • Conduct a practical investigation of effects of forest degradation and interpret the	Guide students to: • Identify causes of deforestation through an assigned practical exercise. • Conduct a practical	computer, climate datasets, maps, GIS software, carbon calculator, field sheets, GPS device.

	impacts of deforestation. 3.4 Describe sustainable forest management. 3.5 Explain forest policies and regulation.	forest management • Discuss forest policies and regulation	case studies, computer, projector, internet resources.	observed results. • Demonstrate environmental and economic impacts of deforestation through an assigned practical exercise.	investigation of effects of forest degradation and interpret the observed results. • Demonstrate environmental and economic impacts of deforestation through an assigned practical exercise.	
General Objective 4.0: Comprehend carbon sequestration, climate mitigation, and adaptation strategies in forestry.						
12-15	4.1 Describe carbon cycle and sequestration. 4.2 Explain climate mitigation strategies. 4.3 Explain adaptation strategies. 4.4 Describe renewable forest resources.	• Explain carbon cycle and sequestration with relevant examples, diagrams or case materials. • Discuss climate mitigation strategies. • Discuss adaptation strategies. • Explain renewable forest resources with relevant examples, diagrams or case materials.	climate-change reports, climate datasets, forest maps, GIS illustrations, case studies, computer, projector, internet resources.	• Observe carbon cycle and sequestration using the specified criteria. • Identify carbon cycle and sequestration using the specified criteria. • Document carbon cycle and sequestration using the specified criteria. • Demonstrate climate mitigation strategies through an assigned practical exercise. • Document renewable forest resources using the specified criteria.	Guide students to: • Observe carbon cycle and sequestration using the specified criteria. • Identify carbon cycle and sequestration using the specified criteria. • Document carbon cycle and sequestration using the specified criteria. • Demonstrate climate	computer, climate datasets, maps, GIS software, carbon calculator, field sheets, GPS device.

					mitigation strategies through an assigned practical exercise. • Document renewable forest resources using the specified criteria.	
COURSE ASSESSMENT Coursework: 10% Tests: 10% Practical: 40% Examination: 40% Total: 100%						





ENVIRONMENTAL IMPACT ASSESSMENT IN WOOD PRODUCTION

PROGRAMME: HIGHER NATIONAL DIPLOMA WOOD AND PAPER TECHNOLOGY (WOOD PRODUCTS PROCESSING TECHNOLOGY OPTION)		
COURSE TITLE: ENVIRONMENTAL IMPACT ASSESSMENT IN WOOD PRODUCTION	COURSE CODE: WPT 321	CONTACT HOURS: 2 HOURS/WEEK
	CREDIT UNIT: 2	THEORETICAL: 1HOUR/WEEK
YEAR: HND 1 SEMESTER: II	PRE-REQUISITE: NIL	PRACTICAL: 1 HOUR/WEEK
GOAL: The course is designed to equip students with knowledge and skills required to assess, evaluate, and manage environmental impacts associated with wood and paper industries.		
GENERAL OBJECTIVES: On completion of this course, the students should be able to: 1.0 Understand the concept and principles of Environmental Impact Assessment (EIA); 2.0 Understand environmental impacts and pollution associated with wood and paper industries.; 3.0 Know the methods and procedures used in conducting Environmental Impact Assessment; 4.0 Understand environmental laws, regulations, and mitigation measures in wood industries; 5.0 Understand sustainable forest resource management and climate protection strategies.		

PROGRAMME: HIGHER NATIONAL DIPLOMA WOOD AND PAPER TECHNOLOGY (WOOD PRODUCTS PROCESSING TECHNOLOGY OPTION)

COURSE TITLE: ENVIRONMENTAL IMPACT ASSESSMENT IN WOOD PRODUCTION:	COURSE CODE: WPT 321	CONTACT HOURS: 2 HOURS/WEEK
	CREDIT UNIT: 2	THEORETICAL
YEAR: I SEMESTER: II	PRE-REQUISITE: NIL	PRACTICAL: 1 HOUR/WEEK

COURSE SPECIFICATION: THEORETICAL AND PRACTICAL

GOAL: This course is designed to equip students with knowledge and skills required to assess, evaluate, and manage environmental impacts associated with wood and paper industries.

GENERAL OBJECTIVE 1.0: Understand the concept and principles of Environmental Impact Assessment (EIA).

THEORETICAL CONTENT				PRACTICAL CONTENT		
Week	Specific Learning Outcome	Teacher's Activities	Resources	Specific Learning Outcome	Teacher's Activities	Resources
1-3	1.1 Explain Environmental Impact Assessment (EIA). 1.2 Outline the objectives of EIA. 1.3 Explain principles of EIA. 1.4 Describe stages involved in EIA. 1.5 Explain benefits of EIA.	• Discuss environmental Impact Assessment. • Explain the objectives of EIA with relevant examples • Discuss principles of EIA. • Explain stages involved in EIA with relevant examples. • Discuss benefits of EIA using relevant examples.	EIA guidelines, environmental regulations, impact checklists, case studies, process-flow diagrams, computer, projector, internet resources.	• Demonstrate environmental Impact Assessment. • Prepare a concise illustrated summary of the objectives of EIA. • Demonstrate principles of EIA. • Analyse an assigned practical case on Environmental Impact Assessment. • Analyse an	Guide students to: • Demonstrate environmental Impact Assessment. • Prepare a concise illustrated summary of the objectives of EIA. • Demonstrate principles of EIA. • Analyse an assigned practical case on Environmental Impact Assessment.	EIA checklist sampling containers field meters GPS device camera maps data sheets PPE.

				assigned practical case on the objectives of EIA. • Analyse an assigned practical case on principles of EIA.	• Analyse an assigned practical case on the objectives of EIA. • Analyse an assigned practical case on principles of EIA.	
General Objective 2.0: Understand environmental impacts and pollution associated with wood and paper industries.						
4-6	2.1 Describe sources of pollution in wood industries. 2.2 Explain effects of industrial pollution. 2.3 Explain air, water, noise and soil pollution in wood industries. 2.4 Describe causes of deforestation and land degradation. 2.5 Explain wood waste management practices.	• Explain sources of pollution in wood industries. • Discuss effects of industrial pollution. • Discuss air, water, noise and soil pollution in wood industries. • Explain causes of deforestation and land degradation. • Discuss wood waste management practices.	EIA guidelines, environmental regulations, impact checklists, case studies, process-flow diagrams, computer, projector, internet resources.	• Identify pollutants in wood workshop. • Classify wood waste materials. • Visit wood waste dump sites. • Demonstrate waste segregation techniques. • Identify sources of pollution in wood industries. • Classify sources of pollution in wood industries using selected samples.	Guide students to: • Identify pollutants in wood workshop. • Classify wood waste materials. • Visit wood waste dump sites. • Demonstrate waste segregation techniques. • Identify sources of pollution in wood industries. • Classify sources of pollution in wood industries using selected samples.	EIA checklist sampling containers field meters GPS device camera maps data sheets PPE.
General Objective 3.0: Know methods and procedures used in conducting Environmental Impact Assessment.						
7-10	3.1 Describe procedures used in EIA. 3.2 Explain	• Discuss procedures used in EIA. • Discuss	EIA guidelines, environmental regulations,	• Demonstrate procedures used in EIA.	Guide students to: • Demonstrate procedures used in	EIA checklist sampling containers

	environmental data collection methods. 3.3 Describe environmental sampling techniques. 3.4 Describe methods of environmental analysis. 3.5 Explain environmental reporting methods.	environmental data collection methods. • Explain environmental sampling techniques. • Explain methods of environmental analysis. • Discuss environmental reporting methods using relevant examples, diagrams and illustrations.	impact checklists, case studies, process-flow diagrams, computer, projector, internet resources.	• Demonstrate environmental data collection methods using relevant software. • Present the output. • Document environmental sampling techniques. • Analyse an assigned practical case on procedures used in EIA. • Analyse an assigned practical case on environmental sampling techniques.	EIA. • Demonstrate environmental data collection methods using relevant software. • Present the output. • Document environmental sampling techniques. • Analyse an assigned practical case on procedures and environmental sampling technique used in EIA.	field meters GPS device camera maps data sheets PPE.
General Objective 4.0: Understand environmental laws, regulations, and mitigation measures in wood industries.						
11-12	4.1 Outline the environmental laws and regulations. 4.2 Explain environmental compliance procedures. 4.3 Describe pollution control measures. 4.4 Explain mitigation	• Explain the environmental laws and regulations. • Discuss environmental compliance procedures. • Explain pollution control measures.	EIA guidelines, environmental regulations, impact checklists, case studies, process-flow diagrams, computer, projector,	• Prepare a concise illustrated summary of the environmental laws and regulations. • Demonstrate environmental compliance procedures.	Guide students to: • Prepare a concise illustrated summary of the environmental laws and regulations. • Demonstrate environmental	EIA checklist sampling containers field meters GPS device camera maps data sheets PPE.

	measures for environmental degradation. 4.5 Explain waste minimization techniques.	• Discuss mitigation measures for environmental degradation using relevant examples, diagrams and illustrations. • Discuss waste minimization techniques using relevant examples, diagrams and illustrations.	internet resources.	• Document pollution control measures. • Analyse an assigned practical case on the environmental laws and regulations. • Apply environmental compliance procedures to an assigned practical case. • Use relevant software for pollution control measures.	compliance procedures. • Document pollution control measures. • Analyse an assigned practical case on the environmental laws and regulations. • Apply environmental compliance procedures to an assigned practical case. • Use relevant software for pollution control measures.	
General Objective 5.0: Understand sustainable forest resource management and climate protection strategies.						
13-15	5.1 Describe sustainable forest management. 5.2 Outline the causes of climate change. 5.3 Describe effects of climate change on forest resources. 5.4 Describe climate change mitigation measures. 5.5 Explain importance	• Explain sustainable forest management. • Explain the causes of climate change. • Explain effects of climate change on forest resources. • Explain climate change mitigation measures.	EIA guidelines, environmental regulations, impact checklists, case studies, process-flow diagrams, computer, projector, internet	• Document sustainable forest management. • Document effects of climate change on forest resources. • Prepare sustainable forest management for an assigned	Guide students to: • Document sustainable forest management. • Document effects of climate change on forest resources. • Prepare sustainable forest management for	EIA checklist sampling containers field meters GPS device camera maps data sheets PPE.

	of environmental sustainability.	• Discuss importance of environmental sustainability	resources.	industry task. • Assess the causes of climate change through a field or laboratory exercise. • Analyse an assigned case on importance of environmental sustainability.	an assigned industry task. • Assess the causes of climate change through a field or laboratory exercise. • Analyse an assigned case on importance of environmental sustainability.	
COURSE ASSESSMENT Coursework: 10% Tests: 10% Practical: 40% Examination: 40% Total: 100%						

SAWMILLING AND TIMBER PROCESSING TECHNOLOGY

PROGRAMME: HIGHER NATIONAL DIPLOMA WOOD AND PAPER TECHNOLOGY (WOOD PRODUCTS PROCESSING TECHNOLOGY OPTION)		
COURSE TITLE: SAWMILLING AND TIMBER PROCESSING TECHNOLOGY	COURSE CODE: WPT 322	CONTACT HOURS: 4 HOURS/WEEK
	CREDIT UNIT: 4	THEORETICAL: 1HOUR/WEEK
YEAR: HND I SEMESTER: II	PRE-REQUISITE:	PRACTICAL: 3 HOURS/WEEK
GOAL: This course is designed to equip students with knowledge and skills in sawmilling operations.		
GENERAL OBJECTIVES: On completion of this course, the students should be able to: 1.0 Understand sawmilling systems and operations; 2.0 Know timber conversion and processing techniques; 3.0 Understand sawmill machine operations, maintenance and safety practices; 4.0 Understand the various sawmilling techniques and sawmill products; 5.0 Understand the activities of the ply milling industry; 6.0 Understand the processes and techniques involved in the manufacture of particle board; 7.0 Understand the processes and techniques involved in the manufacture of fibreboard; 8.0 Know the types and uses of wood veneer and modern wood products; 9.0 Know industrial sawmilling and timber processing practices.		

PROGRAMME: HIGHER NATIONAL DIPLOMA WOOD AND PAPER TECHNOLOGY (WOOD PRODUCTS PROCESSING TECHNOLOGY OPTION)

COURSE TITLE: SAWMILLING AND TIMBER PROCESSING TECHNOLOGY	COURSE CODE: WPT 322	CONTACT HOURS: 4 HOURS/WEEK
	CREDIT UNIT: 4	THEORETICAL: 1HOUR/WEEK
YEAR: I SEMESTER: II	PRE-REQUISITE: NIL	PRACTICAL: 3 HOURS/WEEK

COURSE SPECIFICATION: THEORETICAL AND PRACTICAL

GOAL: This course is designed to equip students with advanced practical competencies in sawmilling operations.

GENERAL OBJECTIVE 1.0: Understand sawmilling systems and operations;

THEORETICAL:				PRACTICAL CONTENT		
Week	Specific Learning Outcome	Teacher's Activities	Resources	Specific Learning Outcome	Teacher's Activities	Resources
1	1.1 Explain sawmilling systems and industrial workflow. 1.2 Describe types of sawmills and processing layouts. 1.3 Describe sawmilling equipment and machine functions. 1.4 Explain factors affecting sawmill productivity and efficiency. 1.5 Outline industrial safety requirements in sawmilling operations.	• Discuss sawmilling systems and industrial workflow. • Explain types of sawmills and processing layouts. • Explain sawmilling equipment and machine functions • Discuss factors affecting sawmill productivity and efficiency. • Discuss industrial safety requirements in sawmilling operations	sawmilling manuals, machine diagrams, conversion charts, maintenance manuals, safety standards, computer, projector, internet resources.	• Identify sawmill machines and their functions. • Draw sawmill process flow diagram. • Observe sawmill operational sequence through field visit/video demonstration. • Record sawmill operational sequence through field visit/video • Prepare sawmill operation checklist.	Guide students to: • Identify sawmill machines and their functions. • Draw sawmill process flow diagram. • Observe sawmill operational sequence through field visit/video demonstration. • Record sawmill operational sequence through field visit/video • Prepare sawmill	timber blocks, sawmill machines or models, measuring tools, maintenance checklist, calculator, practical manual, PPE.

					operation checklist.	
General Objective 2.0: Know timber conversion and processing techniques.						
2	2.1 Describe the external features of the sawmill log. 2.2 Explain the function of the various parts of sawmill 2.3 Describe timber conversion methods and sawing patterns. 2.4 Explain log breakdown and cutting optimization techniques. 2.5 Describe timber sizing and dimensional accuracy. 2.6 Explain causes of timber processing defects.	• Explain the external features of the sawmill log. • Discuss the function of the various parts of sawmill log. • Explain timber conversion methods and sawing patterns • Discuss log breakdown and cutting optimization techniques • Discuss timber sizing and dimensional accuracy • Discuss causes of timber processing defects	sawmilling manuals, machine diagrams, conversion charts, maintenance manuals, safety standards, computer, projector, internet resources.	• Measure logs and estimate timber volume. • Select appropriate sawing pattern for selected log sizes., • Carry out timber cutting and sizing exercises. • Assess dimensional accuracy of processed timber. • Identify defects arising during timber conversion.	Guide students to: • Measure logs and estimate timber volume. • Select appropriate sawing pattern for selected log sizes., • Carry out timber cutting and sizing exercises. • Assess dimensional accuracy of processed timber. • Identify defects arising during timber conversion.	timber blocks, sawmill machines or models, measuring tools, maintenance checklist, calculator, practical manual, PPE.
General Objective 3.0: Understand sawmill machine operations, maintenance and safety practices						
3	3.1 Explain principles of sawmill machine operation. 3.2 Describe preventive maintenance procedures. 3.3 Describe machine	• Discuss principles of sawmill machine operation. • Explain preventive maintenance procedures. • Explain machine	sawmilling manuals, machine diagrams, conversion charts, maintenance	• Demonstrate safe operation of selected sawmill machines. • Conduct routine machine inspection and maintenance exercise.	Guide students to: • Demonstrate safe operation of selected sawmill machines. • Conduct routine	timber blocks, sawmill machines or models, measuring tools, maintenance checklist,

	troubleshooting techniques. 3.4 Explain workshop and sawmill safety requirements.	troubleshooting techniques • Discuss workshop and sawmill safety requirements	manuals, safety standards, computer, projector, internet resources.	• Identify common machine faults and corrective actions. • Conduct sawmill safety inspection using checklist.	machine inspection and maintenance exercise. • Identify common machine faults and corrective actions. • Conduct sawmill safety inspection using checklist.	calculator, practical manual, PPE.
General Objective 4.0: Understand the various sawmilling techniques and sawmill products						
4	4.1 Describe the factors governing the choice of a log for sawmilling. 4.2 Explain the various techniques for log handling 4.3 Describe the various sawmilling techniques Explain integrated sawmilling. 4.4 Describe the principles of waste control in sawmills 4.5 Outline the problems of the sawmill industry and their possible solutions. 4.6 Describe the types of sawn wood and their	• Explain the factors governing the choice of a log for sawmilling • Discuss the various techniques for log handling (Mine detection, transportation and storage) • Explain the various sawmilling techniques • Discuss integrated sawmilling. • Explain the principles of waste control in sawmills • Highlight the problems of the sawmill industry and their possible solutions.	sawmilling manuals, machine diagrams, conversion charts, maintenance manuals, safety standards, computer, projector, internet resources.	• Design an ideal sawmills site and layout. • Perform the various techniques for log handling (Mine detection, transportation and storage). • Perform the various sawmilling techniques (quarter-sawing, plain-sawing, live sawing and taper sawing). • Identify the commercial sizes of sawn wood.	• Design an ideal sawmills site and layout. • Perform the various techniques for log handling (Mine detection, transportation and storage). • Perform the various sawmilling techniques (quarter-sawing, plain-sawing, live sawing and taper sawing). • Identify the commercial	timber blocks, sawmill machines or models, measuring tools, maintenance checklist, calculator, practical manual, PPE.

	uses. 4.7 State the advantages and disadvantages of sawn wood over wood based panel products	• Discuss the advantages and disadvantages of sawn wood over wood based panel products			sizes of sawn wood.	
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5.0 Understand the activities of the ply milling industry

5	5.1 Describe the various steps in the manufacture of veneer. 5.2 Describe the two main methods of cutting decorative veneer. 5.3 Describe the uses of decorative veneers and non-peeled veneers.	• Explain the various steps in the manufacture of veneer. • Explain the two main methods of cutting decorative veneer. • Explain the uses of decorative veneers and non-peeled veneers with relevant examples, diagrams or case materials.	sawmilling manuals, machine diagrams, conversion charts, maintenance manuals, safety standards, computer, projector, internet resources.	• Perform the various steps in the manufacture of veneer: Log preparation - peeling/patching/clipping - peeling/slicing/sawing - drying - sorting/grading and repair of veneer. • Perform the two main methods of cutting decorative veneer: Slicing - semi - rotary cutting. • Perform the uses of decorative veneers and non-peeled veneers.	• Perform the various steps in the manufacture of veneer: Log preparation - peeling/patching/clipping - peeling/slicing/sawing - drying - sorting/grading and repair of veneer. • Perform the two main methods of cutting decorative veneer: Slicing - semi - rotary cutting. • Perform the uses of decorative veneers and non-peeled veneers.	timber blocks, sawmill machines or models, measuring tools, maintenance checklist, calculator, practical manual, PPE.
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General Objective 6.0: Understand the techniques involved in the manufacture of particle board

6-7	6.1 Explain the production sequence of particle board. 6.2 Describe resin blending, particle classification, mat formation and preparation for pressing. 6.3 Describe flat-pressing and extrusion methods 6.4 Explain board finishing, laminating and moulding operations. 6.5 State factors affecting particleboard properties.	• Explain the production sequence of particle board. • Describe resin blending, particle classification, mat formation and preparation for pressing. • Describe flat-pressing and extrusion methods • Explain board finishing, laminating and moulding operations. • State factors affecting particleboard properties.	sawmilling manuals, machine diagrams, conversion charts, maintenance manuals, safety standards, computer, projector, internet resources.	• Draw a process flow chart for the manufacture of particle board. • Produce particle board using the various tools and equipment and applying any of the techniques already described. • Determine the density, weight per unit area, moisture content, moisture absorption and swelling of particle board. • Determine the bending strength, impact strength, compressive strength, shear strength, hardness, and screw/nail holding capacity of particle board.	Guide students to: • Draw a process flow chart for the manufacture of particle board. • Produce particle board using the various tools and equipment and applying any of the techniques already described. • Determine the density, weight per unit area, moisture content, moisture absorption and swelling of particle board. • Determine the bending strength, impact strength, compressive strength, shear strength, hardness, and screw/nail holding capacity of particle board.	timber blocks, sawmill machines or models, measuring tools, maintenance checklist, calculator, practical manual, PPE.
General Objective 7.0 Understand the techniques involved in the manufacture of fibre board						

8-9	7.1 Outline market demand, prospects and commercial grades of fibreboard. 7.2 Describe fibreboard raw materials and the operations used for debarking, chipping, screening and conditioning. 7.3 Describe differences between mechanical, chemical, explosion and Asplund fibre-preparation processes. 7.4 Explain stock sizing, mat formation, wet. 7.5 Explain processes, and wet- and air-felting methods.	• Highlight the development, uses, market demand, prospects and commercial grades of fibreboard. • Explain fibreboard raw materials and the operations used for debarking, chipping, screening and conditioning. • Discuss differences between mechanical, chemical, explosion and Asplund fibre-preparation processes. • Describe stock sizing, mat formation, wet. • Explain processes, and wet- and air-felting methods.	sawmilling manuals, machine diagrams, conversion charts, maintenance manuals, safety standards, computer, projector, internet resources.	• Analyse the available consumption rate of fibre board. • Compare its rate of consumption to those of particle board and plywood. • Assess the prospects of the product in Nigeria in terms of its uses, rate of consumption and the expected standard of living. • Produce fibre boards using various tools and equipment and applying any of the methods already described. • Determine the density, weight per unit area, moisture content, moisture absorption and swelling of fibre board. • Determine the bending strength, impact strength, tensile strength, compressive strength, shear strength, hardness, screw/nail holding	• Analyse the available consumption rate of fibre board. • Compare its rate of consumption to those of particle board and plywood. • Assess the prospects of the product in Nigeria in terms of its uses, rate of consumption and the expected standard of living. • Produce fibre boards using various tools and equipment and applying any of the methods already described. • Determine the density, weight per unit area, moisture content, moisture	timber blocks, sawmill machines or models, measuring tools, maintenance checklist, calculator, practical manual, PPE.
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				capacity of fibre board. • Record explain grades of fibre boards in the market.	absorption and swelling of fibre board. • Determine the bending strength, impact strength, tensile strength, compressive strength, shear strength, hardness, screw/nail holding capacity of fibre board. • Record explain grades of fibre boards in the market.	
General Objective 8.0 Know the types and uses of wood veneer and modern wood products						
10-12	8.1 Describe plywood manufacturing processes and grades. 8.2 Describe the use of different types of plywood. 8.3 Explain the principles of dimensional stabilisation of	• Explain plywood manufacturing processes and grades. • Describe the use of different types of plywood. • Discuss the principles of dimensional stabilisation of wood. • Explain dimensional-stabilisation products	sawmilling manuals, machine diagrams, conversion charts, maintenance manuals, safety standards, computer,	• Perform the manufacturing processes of plywood starting from the wood veneer to the plywood. • Prepare a concise illustrated summary of plywood. • Compare the various uses of the different types of plywood e.g.	• Perform the manufacturing processes of plywood starting from the wood veneer to the plywood. • Prepare a concise illustrated summary of	timber blocks, sawmill machines or models, measuring tools, maintenance checklist, calculator, practical manual, PPE.

	wood. 8.4 Describe dimensional-stabilisation products and their uses.	and their uses.	projector, internet resources.	in building and furniture manufacture using specified criteria. • Present the results in a table or chart. • Demonstrate dimensional Stabilization of wood with examples. • Analyse an assigned practical case on plywood manufacturing processes and grades.	plywood. • Compare the various uses of the different types of plywood e.g. in building and furniture manufacture using specified criteria. • Present the results in a table or chart. • Demonstrate dimensional Stabilization of wood with examples. • Analyse an assigned practical case on plywood manufacturing processes and grades.	
General Objective 9.0: Know industrial sawmilling and timber processing practices						
13–15	9.1 Explain industrial sawmill management systems. 9.2 Describe quality assurance	• Discuss industrial sawmill management systems. • Discuss quality assurance practices in sawmills.	sawmilling manuals, machine diagrams, conversion charts,	• Visit sawmill or timber processing facility and assess workflow, productivity and quality systems. • Demonstrate industrial	Guide students to: • Visit sawmill or timber processing facility and assess workflow, productivity and	timber blocks, sawmill machines or models, measuring tools, maintenance

	practices in sawmills. 9.3 Outline emerging technologies in timber processing. 9.4 Explain industrial supervision practices in timber processing operations.	• Highlight emerging technologies in timber processing. • Discuss industrial supervision practices in timber processing operations using relevant examples, diagrams and illustrations.	maintenance manuals, safety standards, computer, projector, internet resources.	sawmill management systems through an assigned practical exercise. • Demonstrate quality assurance practices in sawmills through an assigned practical exercise. • Identify emerging technologies in timber processing through an assigned practical exercise.	quality systems. • Demonstrate industrial sawmill management systems through an assigned practical exercise. • Demonstrate quality assurance practices in sawmills through an assigned practical exercise. • Identify emerging technologies in timber processing through an assigned practical exercise.	checklist, calculator, practical manual, PPE.
COURSE ASSESSMENT Coursework: 10% Tests: 10% Practical: 40% Examination: 40% Total: 100%						

FOREST OPERATIONS AND TECHNIQUES

PROGRAMME: HIGHER NATIONAL DIPLOMA WOOD AND PAPER TECHNOLOGY (WOOD PRODUCTS PROCESSING TECHNOLOGY OPTION)		
COURSE TITLE: FOREST OPERATIONS AND TECHNIQUES	COURSE CODE: WPT 323	CONTACT HOURS: 4 HOURS/WEEK
	CREDIT UNIT: 4	THEORETICAL: 1HOUR/WEEK
YEAR: I SEMESTER: II	PRE-REQUISITE: WPT 214	PRACTICAL: 3 HOURS/WEEK
GOAL: This course is equipped to provide students with knowledge and skills in forest road, culvert and camps construction, timber and pulpwood harvesting systems.		
GENERAL OBJECTIVES: On completion of this course, the students should be able to: 1.0 Understand the planning, design, and construction of forest roads, culverts, and camps; 2.0 Know the process of obtaining forest concessions in Nigeria; 3.0 Understand the techniques of timber and pulpwood harvesting; 4.0 Understand skidding as an essential operation in the harvesting system; 5.0 Understand the principles and techniques of loading and unloading harvested products; 6.0 Understand the major methods of transporting harvested products to the mill; 7.0 Understand the need for proper timber production management and sustainable forest harvesting practices.		

PROGRAMME: HIGHER NATIONAL DIPLOMA WOOD AND PAPER TECHNOLOGY (WOOD PRODUCTS PROCESSING TECHNOLOGY OPTION)

COURSE TITLE: FOREST OPERATIONS AND TECHNIQUES	COURSE CODE: WPT 323	CONTACT HOURS: 4 HOURS/WEEK
	CREDIT UNIT: 4	THEORETICAL:: 1 HOUR/WEEK
YEAR: I SEMESTER: II	PRE-REQUISITE: NIL	PRACTICAL: 3 HOURS/WEEK

COURSE SPECIFICATION: THEORETICAL AND PRACTICAL

GOAL: This course is equipped to provide students with knowledge and skills in forest road, culvert and camps construction, timber and pulpwood harvesting systems.

GENERAL OBJECTIVE 1.0: Understand the planning, design, and construction of forest roads, culverts, and camps

Week	THEORETICAL			PRACTICAL CONTENT		
	Specific Learning Outcome	Teacher's Activities	Resources	Specific Learning Outcome	Teacher's Activities	Resources
1-2	1.1 Explain the key stages of planning for forest road construction. 1.2 Describe the preliminary preparations required for forest road construction. 1.3 Explain the principles of forest road construction. 1.4 Describe the process of culvert planning, design, and construction 1.5 State the materials and structural requirements	• Explain the key stages of planning for forest road construction. • Describe the preliminary preparations required for forest road construction. • Explain the principles of forest road construction. • Describe the process of culvert planning, design, and construction • State the materials and structural requirements involved	forest-operation manuals, topographic maps, engineering drawings, equipment charts, safety codes, computer, projector, internet resources.	• Perform reading and interpretation of topographic and forest road maps. • Visit a forest road construction or maintenance site • Observe earthwork and drainage features. • Sketch an existing forest bridge or culvert. • Identify materials and structural components. • Construct a simple field camp shelter.	• Perform reading and interpretation of topographic and forest road maps. • Visit a forest road construction or maintenance site • Observe earthwork and drainage features. • Sketch an existing forest bridge or culvert. • Identify materials and structural components. • Construct a simple field camp shelter.	surveying tools, maps, GPS device, measuring tape, road-design templates, field notebook, PPE.

	involved in culvert construction. 1.6 Describe the construction of a forest camp. 1.7 Outline the advantages and limitations of various camp construction materials. 1.8 Explain the importance of routine and periodic road maintenance for sustainable	in culvert construction. • Describe the construction of a forest camp. • Highlight the advantages and limitations of the various camp construction materials in terms of durability, cost, and field practicality. • Discuss the importance of routine and periodic road maintenance		• Inspect a forest road section and identify maintenance needs.	• Inspect a forest road section and identify maintenance needs.	
GENERAL OBJECTIVE 2.0: Know the process of obtaining forest concessions in Nigeria						
3-4	2.1 Explain forest concession and its role in commercial timber production. 2.2 Describe the legal and administrative process of securing a forest concession in Nigeria. 2.3 Describe among the various types of forest concessions available in Nigeria. 2.4 Explain the advantages and	• Discuss forest concession and its role in commercial timber production. • Explain the legal and administrative process of securing a forest concession in Nigeria. • Explain among the various types of forest concessions available in Nigeria. • Discuss the advantages and disadvantages of the various types of	forest-operation manuals, topographic maps, engineering drawings, equipment charts, safety codes, computer, projector, internet resources.	• Perform review of a sample forest concession agreement document. • Compute a simple concession payment estimate using OTV and area-based methods given sample data. • Demonstrate forest concession • Identify the legal and administrative	• Perform review of a sample forest concession agreement document. • Compute a simple concession payment estimate using OTV and area-based methods given sample data. • Demonstrate forest concession • Identify the legal and administrative	surveying tools, maps, GPS device, measuring tape, road-design templates, field notebook, PPE.

	disadvantages of the various types of forest concessions. 2.5 Explain the criteria and methods used for payment of concession rights to forest owners in Nigeria.	forest concessions. • Discuss the criteria and methods used for payment of concession rights to forest owners in Nigeria, including Over-turn Volume (OTV) and area-based payment systems.		process of securing a forest concession in Nigeria • Document the legal and administrative process of securing a forest concession in Nigeria	process of securing a forest concession in Nigeria • Document the legal and administrative process of securing a forest concession in Nigeria	
GENERAL OBJECTIVES 3.0: Understand the techniques of timber and pulpwood harvesting						
5-6	3.1 Describe various types of forest concessions available in Nigeria. 3.2 Explain the advantages and disadvantages of the various types of forest concessions. 3.3 Describe the criteria and methods used for payment of concession rights to forest owners in Nigeria	• Discuss various types of forest concessions available in Nigeria. • Discuss the advantages and disadvantages of the various types of forest concessions. • Explain the criteria and methods used for payment of concession rights to forest owners in Nigeria	forest-operation manuals, topographic maps, engineering drawings, equipment charts, safety codes, computer, projector, internet resources.	• Handle basic harvesting tools and equipment. • Record the function of each. • Assess a standing tree. • Determine the appropriate direction of fall considering lean, wind, and terrain, Limb. • Measure a felled tree or log under supervision • Mark cross-cutting positions, • Cross-cut a prepared log to specification. • Inspect the resulting logs. • Grade the resulting	• Handle basic harvesting tools and equipment. • Record the function of each. • Assess a standing tree. • Determine the appropriate direction of fall considering lean, wind, and terrain, Limb. • Measure a felled tree or log under supervision • Mark cross-cutting positions, • Cross-cut a prepared log to specification. • Inspect the resulting logs. • Grade the resulting	surveying tools, maps, GPS device, measuring tape, road-design templates, field notebook, PPE.

				logs. • Prepare a concise illustrated summary of the principal operations in timber harvesting.	logs. • Prepare a concise illustrated summary of the principal operations in timber harvesting.	
GENERAL OBJECTIVE 4.0: Understand skidding as an essential operation in the harvesting system						
7-8	4.1 Explain the role of skidding in the overall harvesting system. 4.2 Describe the two principal types of skidding. 4.3 Describe the methods of skidding. 4.4 Highlight the advantages and disadvantages of each method.	• Explain the role of skidding in the overall harvesting system, including its relationship with felling, loading, and haulage. • Describe the two principal types of skidding. • Explain the methods of skidding. • Outline the advantages and disadvantages of each method.	forest-operation manuals, topographic maps, engineering drawings, equipment charts, safety codes, computer, projector, internet resources.	• Identify the skidding method in use. • Evaluate its suitability for the terrain. • Interpret the observed results. • Document the two principal types of skidding. • Analyse an assigned case on the role of skidding in the overall harvesting system, including its relationship with felling, loading, and haulage.	• Identify the skidding method in use. • Evaluate its suitability for the terrain. • Interpret the observed results. • Document the two principal types of skidding. • Analyse an assigned case on the role of skidding in the overall harvesting system, including its relationship with felling, loading, and haulage.	surveying tools, maps, GPS device, measuring tape, road-design templates, field notebook, PPE.
GENERAL OBJECTIVE 5.0: Understand the principles and techniques of loading and unloading harvested products						
9-10	5.1 Describe the methods of loading and securing of logs. 5.2 Explain the basic principles involved in each of the	• Discuss the methods of loading and securing of logs. • Describe basic principles involved in each of the methods.	forest-operation manuals, topographic maps, engineering drawings,	• Visit site to identify loading equipment. • Perform loading exercise. • Prepare a concise illustrated summary	• Visit site to identify loading equipment. • Perform loading exercise. • Prepare a concise illustrated summary	surveying tools, maps, GPS device, measuring tape, road-design

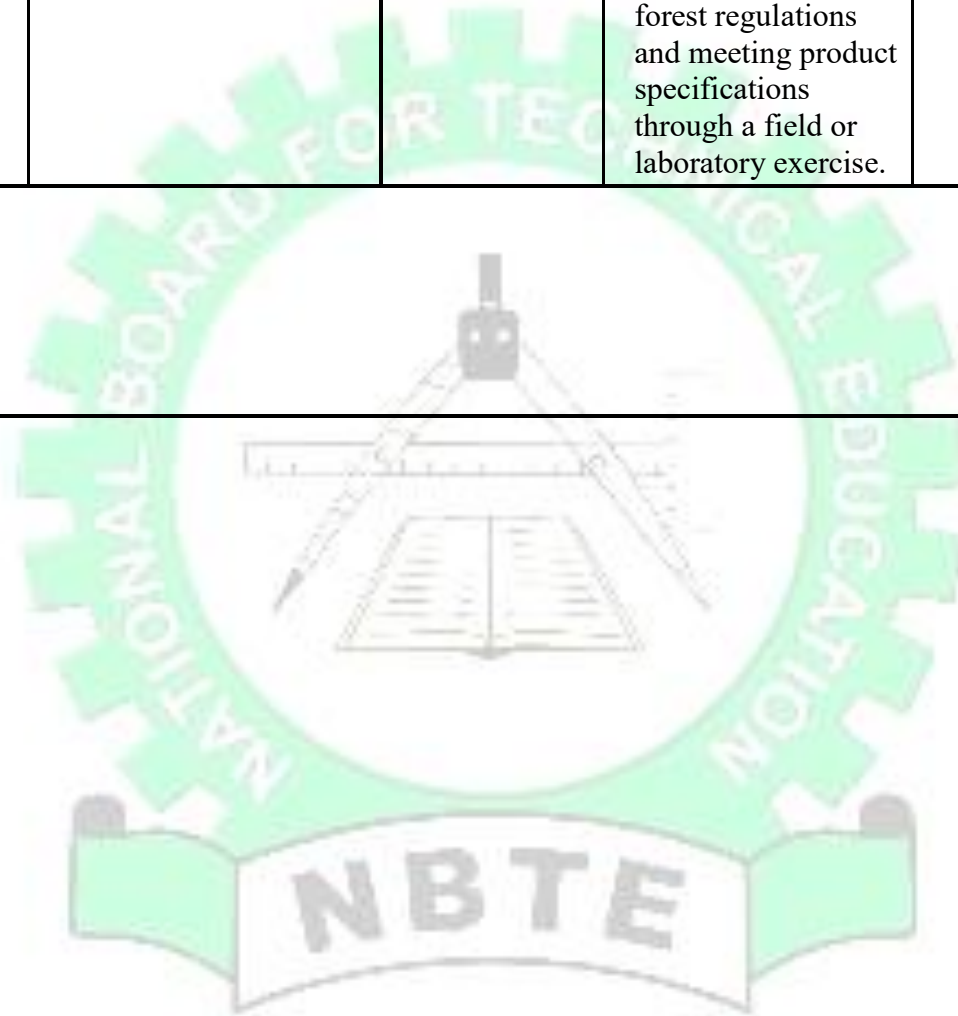
	methods. 5.3 Explain hand loading, gravity loading and cross-haul loading. 5.4 Outline advantages of the selected loading method. 5.5 Explain loading and unloading procedures for harvested products.	• Explain hand loading, gravity loading and cross-haul loading. • Highlight advantages of the selected loading method. • Explain loading and unloading procedures for harvested products.	equipment charts, safety codes, computer, projector, internet resources.	of the methods of loading and securing of logs. • Document the methods and basic principles involved in each of the methods. • Demonstrate hand loading, gravity loading and cross-haul loading • Analyse an assigned practical case on the methods of loading and securing of logs.	of the methods of loading and securing of logs. • Document the methods and basic principles involved in each of the methods. • Demonstrate hand loading, gravity loading and cross-haul loading • Analyse an assigned practical case on the methods of loading and securing of logs.	templates, field notebook, PPE.
GENERAL OBJECTIVE 6.0: Understand the major methods of transporting (hauling) harvested products to the mill						
11-12	6.1 Explain Hauling. 6.2 Describe the different methods of hauling harvested forest products. 6.3 Explain the advantages and disadvantages of haulage method 6.4 State the conditions of haulage method	• Discuss hauling using relevant examples, diagrams and illustrations. • Explain the different methods of hauling harvested forest products. • Discuss the advantages and disadvantages of haulage methods • Explain the conditions of haulage method	forest-operation manuals, topographic maps, engineering drawings, equipment charts, safety codes, computer, projector, internet resources.	• Carry out hauling exercise. • Demonstrate hauling through an assigned practical exercise. • Identify the different methods of hauling harvested forest products using the specified criteria.	• Guide students to: • Perform carry out hauling exercise. • Demonstrate hauling through an assigned practical exercise. • Identify the different methods of hauling harvested forest products using the specified criteria.	surveying tools, maps, GPS device, measuring tape, road-design templates, field notebook, PPE.
GENERAL OBJECTIVE 7.0: Understand the need for proper timber production management and sustainable forest harvesting practices						

13-15	7.1 Highlight the importance of effective production management in timber harvesting operations. 7.2 Describe strategies for reducing costs in timber harvesting 7.3 Describe safety regulations and occupational health measures in timber harvesting operations. 7.4 Describe Reduced Impact Logging (RIL). 7.5 Describe advantages of Reduced Impact Logging (RIL) over conventional logging.	• Outline the importance of effective production management in timber harvesting operations. • Explain strategies for reducing costs in timber harvesting • Discuss safety regulations and occupational health measures in timber harvesting operations. • Explain Reduced Impact Logging (RIL). • Discuss advantages of Reduced Impact Logging (RIL) over conventional logging.	forest-operation manuals, topographic maps, engineering drawings, equipment charts, safety codes, computer, projector, internet resources.	• Prepare a production plan and cost estimate for a simulated timber-harvesting operation. • Conduct a safety, regulatory-compliance and Reduced Impact Logging audit of an assigned harvesting site or case study. • Evaluate product specifications, operational efficiency and environmental impacts using an approved checklist. • Develop corrective actions for identified production, safety and sustainability gaps. • Assess the importance of effective production management in timber harvesting operations using the approved procedure. • Assess strategies for	Guide students to: • Prepare a production plan and cost estimate for a simulated timber-harvesting operation. • Conduct a safety, regulatory-compliance and Reduced Impact Logging audit of an assigned harvesting site or case study. • Evaluate product specifications, operational efficiency and environmental impacts using an approved checklist. • Develop corrective actions for identified production, safety and sustainability gaps.	surveying tools, maps, GPS device, measuring tape, road-design templates, field notebook, PPE.
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				reducing costs in timber harvesting and adherence to forest regulations and meeting product specifications through a field or laboratory exercise.		
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COURSE ASSESSMENT

Coursework: 10%
Tests: 10%
Practical: 40%
Examination: 40%
Total: 100%



FOREST CERTIFICATION AND TIMBER TRACEABILITY

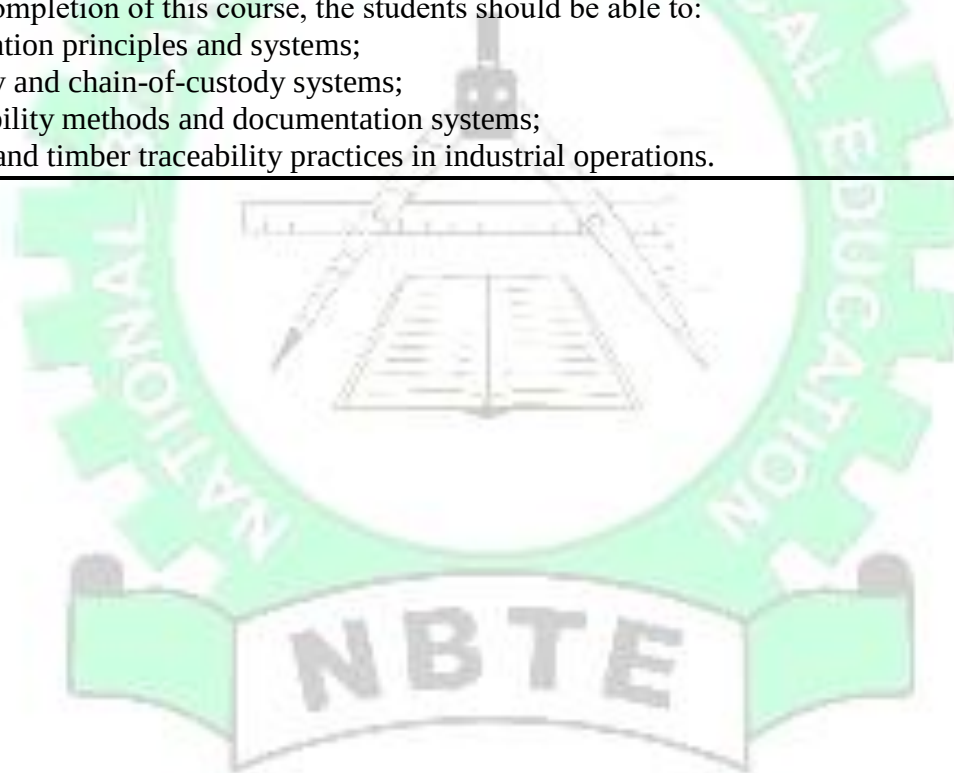
PROGRAMME: HIGHER NATIONAL DIPLOMA WOOD AND PAPER TECHNOLOGY (WOOD PRODUCTS PROCESSING TECHNOLOGY OPTION)

COURSE TITLE: FOREST CERTIFICATION AND TIMBER TRACEABILITY	COURSE CODE: WPT 324	CONTACT HOURS: 4 HOURS/WEEK
	CREDIT UNIT: 4	THEORETICAL: 1HOUR/WEEK
YEAR: HND 1 SEMESTER: II	PRE-REQUISITE: NIL	PRACTICAL: 3 HOURS/WEEK

GOAL: This course is designed to equip students with knowledge and skills in forest certification, timber legality, traceability systems and chain-of-custody practices.

GENERAL OBJECTIVES: On completion of this course, the students should be able to:

- 1.0 Understand forest certification principles and systems;
- 2.0 Understand timber legality and chain-of-custody systems;
- 3.0 Understand timber traceability methods and documentation systems;
- 4.0 Know forest certification and timber traceability practices in industrial operations.



PROGRAMME: HIGHER NATIONAL DIPLOMA WOOD AND PAPER TECHNOLOGY (WOOD PRODUCTS PROCESSING TECHNOLOGY OPTION)**COURSE TITLE: FOREST CERTIFICATION AND TIMBER TRACEABILITY****COURSE CODE: WPT 324****CONTACT HOURS: 4 HOURS/WEEK****CREDIT UNIT: 4****THEORETICAL: 1HOUR/WEEK****YEAR: I SEMESTER: II****PRE-REQUISITE: NIL****PRACTICAL: 3 HOURS/WEEK****COURSE SPECIFICATION: THEORETICAL AND PRACTICAL****GOAL:** This course is designed to equip students with knowledge and skills in forest certification, timber legality, traceability systems and chain-of-custody practices.**GENERAL OBJECTIVE 1.0:** Understand forest certification principles and systems

THEORETICAL				PRACTICAL CONTENT		
Week	Specific Learning Outcome	Teacher's Activities	Resources	Specific Learning Outcome	Teacher's Activities	Resources
1-4	1.1 Explain the concept and importance of forest certification. 1.2 Describe principles of sustainable forest management. 1.3 Explain forest certification systems and standards. 1.4 Describe benefits and challenges of forest certification. 1.5 Explain the role of certification in responsible timber production and trade.	- Describe the concept and importance of forest certification - Explain principles of sustainable forest management. - Discuss forest certification systems and standards - Discuss benefits and challenges of forest certification - Discuss the role of certification in responsible timber production and trade.	Textbooks, Charts, Computer, Projector, Internet Resources, Journal, Whiteboard, Marker, etc.	- Identify certified and non-certified timber products. - Compare labels and certification marks on wood products. - Prepare simple certification checklist for timber products. - Demonstrate the concept and importance of forest certification through an assigned practical exercise.	Guide students to: - Identify certified and non-certified timber products. - Compare labels and certification marks on wood products. - Prepare simple certification checklist for timber products. - Demonstrate the concept and importance of forest certification through an assigned practical exercise.	certification checklist, chain-of-custody forms, timber tags, barcode or QR tools, audit forms, sample records.

General Objective 2.0: Understand timber legality and chain-of-custody systems

5-7	2.1 Explain timber legality requirements and regulations. 2.2 Describe chain-of-custody principles in timber production and marketing. 2.3 Explain procedures for timber movement and tracking. 2.4 Describe documentation requirements for legal timber trade.	• Describe timber legality requirements and regulations • Describe chain-of-custody principles in timber production and marketing • Discuss procedures for timber movement and tracking. • Discuss documentation requirements for legal timber trade	Textbooks, Charts, Computer, Projector, Internet Resources, Journal, Whiteboard, Marker, etc.	• Examine sample timber permits, waybills, invoices and chain-of-custody records for legality and completeness. • Trace a tagged timber consignment from forest source through transport, processing and marketing stages. • Complete a timber movement and tracking register using manual or digital identification codes. • Identify non-conformities • Recommend corrective actions for legal timber trade. • Demonstrate timber legality requirements and regulations through an assigned practical exercise.	Guide students to: • Examine sample timber permits, waybills, invoices and chain-of-custody records for legality and completeness. • Trace a tagged timber consignment from forest source through transport, processing and marketing stages. • Complete a timber movement and tracking register using manual or digital identification codes. • Identify non-conformities • Recommend corrective actions for legal timber trade. • Demonstrate timber legality requirements and regulations through an assigned practical exercise.	certification checklist, chain-of-custody forms, timber tags, barcode or QR tools, audit forms, sample records.
General Objective 3.0: Understand timber traceability methods and documentation systems						
8-11	3.1 Explain timber traceability concepts and importance. 3.2 Explain timber	• Discuss timber traceability concepts and importance • Discuss timber	Textbooks, Charts, Computer, Projector,	• Demonstrate timber traceability concepts and importance through an assigned	Guide students to: • Demonstrate timber traceability concepts and importance	certification checklist, chain-of-custody

	tagging, coding and labeling systems. 3.3 Describe digital and manual timber record systems. 3.4 Explain quality and inventory tracking in timber industries.	tagging, coding and labeling systems. • Explain digital and manual timber record systems. • Describe quality and inventory tracking in timber industries	Internet Resources, Journal, Whiteboard, Marker, etc.	practical exercise. • Demonstrate timber tagging, coding and labeling systems through an assigned practical exercise. • Use relevant software or digital tools • Demonstrate digital and manual timber record systems and present the output.	through an assigned practical exercise. • Demonstrate timber tagging, coding and labeling systems through an assigned practical exercise. • Use relevant software or digital tools • Demonstrate digital and manual timber record systems and present the output.	forms, timber tags, barcode or QR tools, audit forms, sample records.
General Objective 4.0: Know forest certification and timber traceability practices in industrial operations						
12-15	4.1 Explain industrial certification procedures and compliance requirements. 4.2 Explain timber traceability in export and local markets. 4.3 Describe quality assurance and compliance monitoring in timber industries. 4.4 Explain emerging trends in forest certification and digital traceability systems.	• Discuss industrial certification procedures and compliance requirements • Describe timber traceability in export and local markets • Discuss quality assurance and compliance monitoring in timber industries • Explain emerging trends in forest certification and digital traceability systems	Textbooks, Charts, Computer, Projector, Internet Resources, Journal, Whiteboard, Marker, etc.	• Visit timber yard, forestry office or sawmill and assess traceability practices. • Conduct certification checklist. • Demonstrate industrial certification procedures and compliance requirements through an assigned practical exercise. • Demonstrate timber traceability in export and local markets through an assigned practical exercise.	Guide students to: • Visit timber yard, forestry office or sawmill and assess traceability practices. • Conduct certification checklist. • Demonstrate industrial certification procedures and compliance requirements through an assigned practical exercise. • Demonstrate timber traceability in export and local markets through an assigned practical exercise.	certification checklist, chain-of-custody forms, timber tags, barcode or QR tools, audit forms, sample records.

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COURSE ASSESSMENT

Coursework: 10%
Tests: 10%
Practical: 40%
Examination: 40%
Total: 100%



WOOD WASTE UTILIZATION AND CIRCULAR BIOECONOMY

PROGRAMME: HIGHER NATIONAL DIPLOMA WOOD AND PAPER TECHNOLOGY (WOOD PRODUCTS PROCESSING TECHNOLOGY OPTION)		
COURSE TITLE: WOOD WASTE UTILIZATION AND CIRCULAR BIOECONOMY	COURSE CODE: WPT 325	CONTACT HOURS: 4 HOURS/WEEK
	CREDIT UNIT: 4	THEORETICAL: 1HOUR/WEEK
YEAR: HND I SEMESTER: II	PRE-REQUISITE: NIL	PRACTICAL: 3 HOURS/WEEK
GOAL: This course is designed to equip students with knowledge and skills in wood waste utilization, recycling, biomass conversion and circular bioeconomy practices.		
GENERAL OBJECTIVES: On completion of this course, the students should be able to: 1.0 Understand sources, types and characteristics of wood waste; 2.0 Understand wood waste utilization and recycling technologies; 3.0 Understand biomass conversion and value addition from wood residues; 4.0 Understand circular bioeconomy principles in wood industries; 5.0 Apply wood waste utilization and circular bioeconomy practices in industrial operations; 6.0 Understand production planning principles in wood industries.		

PROGRAMME: HIGHER NATIONAL DIPLOMA WOOD AND PAPER TECHNOLOGY (WOOD PRODUCTS PROCESSING TECHNOLOGY OPTION)

COURSE TITLE: WOOD WASTE UTILIZATION AND CIRCULAR BIOECONOMY	COURSE CODE: WPT 325	CONTACT HOURS: 4 HOURS/WEEK
	CREDIT UNIT: 4	THEORETICAL: 1HOUR/WEEK
YEAR: I SEMESTER: II	PRE-REQUISITE: NIL	PRACTICAL: 3 HOURS/WEEK

COURSE SPECIFICATION: THEORETICAL AND PRACTICAL

GOAL: This course is designed to equip students with knowledge and skills in wood waste utilization, recycling, biomass conversion and circular bioeconomy practices.

GENERAL OBJECTIVE 1.0: Understand sources, types and characteristics of wood waste

THEORETICAL CONTENT				PRACTICAL CONTENT		
Week	Specific Learning Outcome	Teacher's Activities	Resources	Specific Learning Outcome	Teacher's Activities	Resources
1-3	1.1 Explain sources of wood waste in wood industries. 1.2 Describe types of wood waste: sawdust, wood shavings, bark, chips, off-cuts and residues. 1.3 Explain causes of wood waste generation. 1.4 Explain environmental implications of poor wood waste management.	• Discuss sources of wood waste in wood industries. • Explain types of wood waste: sawdust, wood shavings, bark, chips, off-cuts and residues. • Discuss causes of wood waste generation. • Discuss environmental implications of poor wood waste management.	Textbooks, Charts, Computer, Projector, Internet Resources, Journal, Whiteboard, Marker, etc.	• Identify and classify different wood waste materials. • Quantify wood waste generated from workshop activities. • Compare waste generation from different wood operations. • Identify sources of wood waste in wood industries through an assigned practical exercise. • Carry out observation, identification and	Guide students to: • Identify and classify different wood waste materials. • Quantify wood waste generated from workshop activities. • Compare waste generation from different wood operations. • Identify sources of wood waste in wood industries through an assigned	Wood residues, sorting bins, balance, size-reduction equipment, briquetting or composite tools, material-balance sheets, PPE.

				documentation of wood waste types: sawdust, wood shavings, bark, chips, off-cuts and residues using the specified criteria. • Demonstrate environmental implications of poor wood waste management through an assigned practical exercise.	practical exercise. • Carry out observation, identification and documentation of wood waste types: sawdust, wood shavings, bark, chips, off-cuts and residues using the specified criteria. • Demonstrate environmental implications of poor wood waste management through an assigned practical exercise.	
General Objective 2.0: Understand wood waste utilization and recycling technologies						
4-7	2.1 Explain methods of wood waste utilization. 2.2 Explain recycling technologies for wood residues. 2.3 Explain conversion of wood waste into useful products. 2.4 Explain waste minimization strategies in wood industries.	• Discuss methods of wood waste utilization. • Discuss recycling technologies for wood residues. • Discuss conversion of wood waste into useful products. • Discuss waste minimization strategies in wood industries.	Textbooks, Charts, Computer, Projector, Internet Resources, Journal, Whiteboard, Marker, etc.	• Produce simple recycled wood products from off-cuts and residues. • Demonstrate Reuse sawdust and wood particles in simple composite products. • Compare waste reuse methods. • Prepare recycling assessment report.	Guide students to: • Produce simple recycled wood products from off-cuts and residues. • Demonstrate Reuse sawdust and wood particles in simple composite products. • Compare waste reuse methods. • Prepare recycling assessment report.	Wood residues, sorting bins, balance, size-reduction equipment, briquetting or composite tools, material-balance sheets, PPE.

General Objective 3.0 Understand biomass conversion and value addition from wood residues:

8-10	3.1 Explain biomass and bioenergy concepts. 3.2 Describe briquette production from wood residues. 3.3 Explain value-added products from wood waste. 3.4 Describe benefits and limitations of biomass utilisation.	• Describe biomass and bioenergy concepts. • Discuss briquette production from wood residues. • Explain value-added products from wood waste. • Discuss benefits and limitations of biomass utilisation.	Textbooks, Charts, Computer, Projector, Internet Resources, Journal, Whiteboard, Marker, etc.	• Produce simple wood briquettes using sawdust and binder. • Compare briquette quality from different materials. • Assess burning characteristics of briquettes under controlled conditions. • Demonstrate biomass and bioenergy concepts through an assigned practical exercise.	Guide students to: • Produce simple wood briquettes using sawdust and binder. • Compare briquette quality from different materials. • Assess burning characteristics of briquettes under controlled conditions. • Demonstrate biomass and bioenergy concepts through an assigned practical exercise.	Wood residues, sorting bins, balance, size-reduction equipment, briquetting or composite tools, material-balance sheets, PPE.
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General Objective 4.0: Understand circular bioeconomy principles in wood industries

11-12	4.1 Explain circular bioeconomy principles. 4.2 Explain waste reduction and reuse systems in wood industries. 4.3 Explain sustainable industrial production practices. 4.4 Explain environmental and economic benefits of circular systems.	• Discuss circular bioeconomy principles. • Discuss waste reduction and reuse systems in wood industries. • Discuss sustainable industrial production practices.	Textbooks, Charts, Computer, Projector, Internet Resources, Journal, Whiteboard, Marker, etc.	• Classify reusable and non-reusable wood waste. • Develop simple waste reuse plan for wood workshop. • Demonstrate circular bioeconomy principles through an assigned practical exercise. • Demonstrate	Guide students to: • Classify reusable and non-reusable wood waste. • Develop simple waste reuse plan for wood workshop. • Demonstrate circular bioeconomy principles through	wood residues, sorting bins, balance, size-reduction equipment, briquetting or composite tools, material-balance
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		• Discuss environmental and economic benefits of circular systems.		sustainable industrial production practices through an assigned practical exercise.	an assigned practical exercise. • Demonstrate sustainable industrial production practices through an assigned practical exercise.	sheets, PPE.
General Objective 5.0: Apply wood waste utilization and circular bioeconomy practices in industrial operations						
13-14	5.1 Explain industrial waste management systems in wood industries. 5.2 Explain quality and safety considerations in waste reuse. 5.3 Explain emerging trends in biomass and circular bio-economy systems. 5.4 Explain entrepreneurship opportunities in wood waste utilization.	• Discuss industrial waste management systems in wood industries. • Discuss quality and safety considerations in waste reuse • Discuss emerging trends in biomass and circular bio-economy systems. • Discuss entrepreneurship opportunities in wood waste utilization.	Textbooks, Charts, Computer, Projector, Internet Resources, Journal, Whiteboard, Marker, etc.	• Visit sawmills, furniture workshop or biomass facility and assess waste management practices. • Evaluate wood waste utilization methods observed in industry. • Develop simple business idea on wood waste utilization. • Demonstrate industrial waste management systems in wood industries through an assigned practical exercise.	Guide students to: • Visit sawmills, furniture workshop or biomass facility and assess waste management practices. • Evaluate wood waste utilization methods observed in industry. • Develop simple business idea on wood waste utilization. • Demonstrate industrial waste management systems in wood industries through an assigned practical exercise.	Wood residues, sorting bins, balance, size-reduction equipment, briquetting or composite tools, material-balance sheets, PPE.

General Objective 6.0: Understand production planning principles in wood industries

15	6.1 Explain production planning concepts in wood industries. 6.2 Explain production workflow and scheduling. 6.3 Explain factors affecting production planning. 6.4 Explain roles of production supervision in wood industries.	• Discuss production planning concepts in wood industries. • Discuss production workflow and scheduling. • Discuss factors affecting production planning. • Discuss roles of production supervision in wood industries.	Textbooks, Charts, Computer, Projector, Internet Resources, Journal, Whiteboard, Marker, etc.	• Prepare simple production schedule for furniture or timber processing operation. • Draw workflow chart for selected wood production activity. • Compare production sequences for different wood products. • Demonstrate production planning concepts in wood industries through an assigned practical exercise. • Demonstrate production workflow and scheduling through an assigned practical exercise.	Guide students to: • Prepare simple production schedule for furniture or timber processing operation. • Draw workflow chart for selected wood production activity. • Compare production sequences for different wood products. • Demonstrate production planning concepts in wood industries through an assigned practical exercise. • Demonstrate production workflow and scheduling through an assigned practical exercise.	Wood residues, sorting bins, balance, size-reduction equipment, briquetting or composite tools, material-balance sheets, PPE.
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COURSE ASSESSMENT:**Course Work:** 10%**Test/Assignments:** 10%**Practical:** 40%

Examination:	40%
Total:	100%



BIODETERIORATION OF WOOD

PROGRAMME: HIGHER NATIONAL DIPLOMA WOOD AND PAPER TECHNOLOGY (WOOD PRODUCTS PROCESSING TECHNOLOGY OPTION)		
COURSE TITLE: BIODETERIORATION OF WOOD	COURSE CODE: WPT 326	CONTACT HOURS: 3 HOURS/WEEK
	CREDIT UNIT: 3	THEORETICAL: 1HOUR/WEEK
YEAR: I SEMESTER: II	PRE-REQUISITE: NIL	PRACTICAL: 2 HOURS/WEEK
GOAL: The course is designed to equip students with the knowledge and skills of agents of bio-deterioration of wood in the forest, mill yard and in service and ability to combat them.		
GENERAL OBJECTIVES: On completion of this course, the students should be able to: 1.0 Know wood destroying fungi; 2.0 Understand the physiology of growth of wood-rotting fungi; 3.0 Understand the morphological, physical and chemical changes in wood caused by wood rotting fungi; 4.0 Know various wood destroying insects and their mode of action; 5.0 Understand methods of prevention and control of bio deterioration of woods.		

PROGRAMME: HIGHER NATIONAL DIPLOMA WOOD AND PAPER TECHNOLOGY (WOOD PRODUCTS PROCESSING TECHNOLOGY OPTION)						
COURSE TITLE: BIODETERIORATION OF WOOD			COURSE CODE: WPT 326		CONTACT HOURS: 3 HOURS/WEEK	
			CREDIT UNIT: 3		THEORETICAL:1HOUR/WEEK	
YEAR: I SEMESTER: II			PRE-REQUISITE: NIL		PRACTICAL: 2 HOURS/WEEK	
COURSE SPECIFICATION: THEORETICAL AND PRACTICAL						
GOAL: The course is designed to equip students with the knowledge and skills of agents of bio-deterioration of wood in the forest, mill yard and in service and ability to combat them.						
GENERAL OBJECTIVE 1.0: Know wood destroying fungi.						
THEORETICAL CONTENT				PRACTICAL CONTENT		
Week	Specific Learning Outcome	Teacher’s Activities	Resources	Specific Learning Outcome	Teacher’s Activities	Resources
1-3	1.1 Describe the structure of fungi. 1.2 Explain wood destroying fungi into families according to forms of their cells. 1.3 Explain the life history of fungi. 1.2 Describe: i. Pathogens of standing trees and newly felled logs; ii. Pathogens of wood in storage; iii. Pathogens of wood in construction e.g. poles, building and furniture.	• Explain the structure of fungi. • Discuss wood destroying fungi into families according to forms of their cells. • Describe the life history of fungi. • Explain ✓ Pathogens of standing trees and newly felled logs; ✓ Pathogens of wood in storage; ✓ Pathogens of wood in construction e.g. poles, building and furniture	Textbooks, Charts, Computer, Projector, Internet Resources, Journal, Whiteboard, Marker, etc.	• Identify: - Pathogens of standing trees and newly felled logs; - Pathogens of wood in storage; - Pathogens of wood in construction e.g. poles, building and furniture. • Carry out observation, identification and documentation the structure of fungi using the specified criteria. • Carry out observation, identification and documentation wood	Guide students to: • Identify - Pathogens of standing trees and newly felled logs; - Pathogens of wood in storage; - Pathogens of wood in construction e.g. poles, building and furniture. • Carry out observation, identification and documentation the structure of fungi using the specified	Wood specimens, microscopes, culture plates, insect samples or images, preservatives, test chambers, PPE.

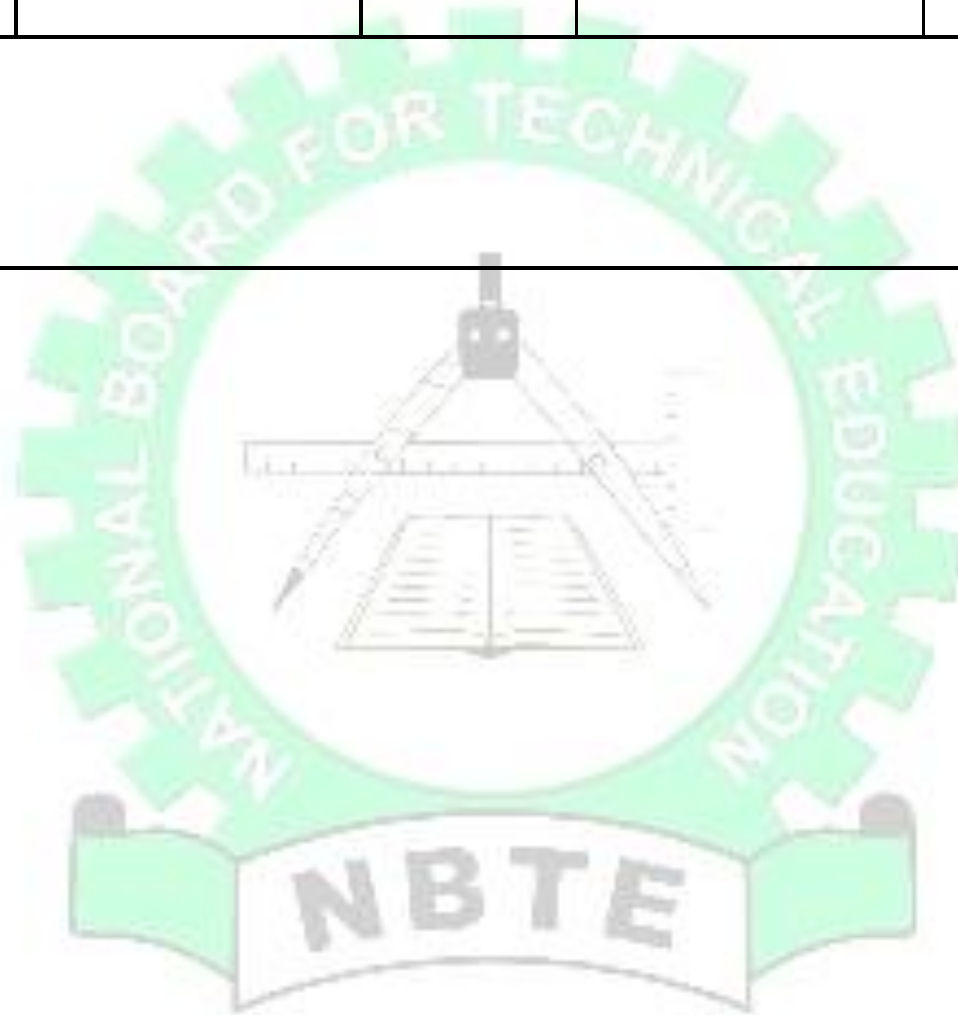
				destroying fungi into families according to forms of their cells using the specified criteria.	criteria. • Carry out observation, identification and documentation wood destroying fungi into families according to forms of their cells using the specified criteria.	
General Objective 2.0: Understand the physiology of growth of wood-rotting fungi						
4-6	2.1 Explain wood as nutrient for fungi. 2.2 Describe fungi respiration. 2.3 Outline mode of action of wood destroying fungal enzymes e.g. oxidising and hydrolysing enzymes, cellulose hemicellulose, and lignin splitting enzymes etc. 2.4 Describe mode of action of wood destroying fungal enzymes. 2.5 Outline the factors determining the growth of wood destroying fungi	• Discuss wood as nutrient for fungi. • Explain fungi respiration. • Explain mode of action of wood destroying fungal enzymes e.g. oxidising and hydrolysing enzymes, cellulose hemicellulose, and lignin splitting enzymes etc. • Explain mode of action of wood destroying fungal enzymes • Explain the factors determining the growth of wood destroying fungi e.g. moisture content of wood, temperature, PH, light	Textbooks, Charts, Computer, Projector, Internet Resources, Journal, Whiteboard, Marker, etc.	• Prepare sterile wood blocks • Expose them to selected wood-decay fungi under controlled laboratory conditions. • Vary moisture, temperature or pH conditions • Monitor fungal growth and visible decay symptoms. • Determine percentage mass loss or other measurable deterioration of exposed wood specimens. • Relate observed decay patterns to fungal respiration, enzyme action and environmental growth	Guide students to: • Prepare sterile wood blocks • Expose them to selected wood-decay fungi under controlled laboratory conditions. • Vary moisture, temperature or pH conditions • Monitor fungal growth and visible decay symptoms. • Determine percentage mass loss or other measurable deterioration of exposed wood specimens. • Relate observed decay patterns to	Wood specimens, microscopes, culture plates, insect samples or images, preservatives, test chambers, ppe.

	2.6 Describe the factors determining the growth of wood destroying fungi in.	etc. • Explain the factors determining the growth of wood destroying fungi.		factors. • Demonstrate wood as nutrient for fungi through an assigned practical exercise. • Carry out observation, identification and documentation fungi respiration using the specified criteria.	fungus respiration, enzyme action and environmental growth factors. • Demonstrate wood as nutrient for fungi through an assigned practical exercise. • Carry out observation, identification and documentation fungi respiration using the specified criteria.	
General Objective 3.0: Understand the morphological, physical and chemical changes in wood caused by wood-rotting fungi						
7-9	3.1 Describe the symptoms of fungi decay 3.2 Explain the effects of fungal decay on, including i. Physical properties of wood e.g. density, colour, shrinkage, etc. ii. Electrical and thermal properties of wood. iii. Mechanical properties of wood. 3.3 Describe wood-rotting fungi into:	• Explain the symptoms of fungi decay e.g. change in color, change of odour, density and softness. • Discuss the effects of fungal decay on, including i. Physical properties of wood e.g. density, colour, shrinkage, etc. ii. (Electrical and thermal properties of wood. iii. Mechanical properties of wood e.g. hardness,	Textbooks, Charts, Computer, Projector, Internet Resources, Journal, Whiteboard, Marker, etc.	• Identify symptoms of fungi decay e.g. change in color, change of odour, density and softness. • Classify wood-rotting fungi into brown rot, white rot and soft rot. • Create visual content to morphological changes produced by each type of rot. • Identify the chemical changes in wood during fungal decay. • Identify the conditions necessary for the growth of wood-rotting	Guide students to: • Identify symptoms of fungi decay e.g. change in color, change of odour, density and softness. • Classify wood-rotting fungi into brown rot, white rot and soft rot. • Create visual content to morphological changes produced by each type of rot. • Identify the chemical changes in wood during fungal	Wood specimens, microscopes, culture plates, insect samples or images, preservatives, test chambers, PPE.

	i. Brown rot ii. White rot iii. Soft rot. 3.4 Describe the morphological changes produced in wood by brown rot, white rot and soft rot. 3.5 Explain the chemical changes that occur in wood during fungal decay 3.6 Outline the conditions necessary for the growth of wood-rotting fungi	strengths, etc. • Explain wood-rotting fungi into: ✓ Brown rot ✓ White rot ✓ Soft rot • Explain the morphological changes produced in wood by brown rot, white rot and soft rot • Discuss the chemical changes that occur in wood during fungal decay e.g. breakdown of cellulose, hemicellulose and lignin • Explain the conditions necessary for the growth of wood-rotting fungi e.g. moisture, temperature, air and food.		fungi.	decay. • Identify the conditions necessary for the growth of wood-rotting fungi.	
General Objective 4.0: Know various wood destroying insects and their mode of action						
10-12	4.1 Describe insects and fungal attack on wood. 4.2 Describe mode of attack of wood destroying insects on: i. Standing trees and	• Explain insects and fungal attack on wood. • Explain mode of attack of wood destroying insects on; i. Standing trees and	Textbooks, Charts, Computer, Projector, Internet Resources, Journal,	• Identify insects attack on wood, fungal attack on wood. • Identify insect attack on, Standing trees and newly felled logs • Identify the life cycle of	Guide students to: • Identify insects attack on wood, fungal attack on wood. • Identify insect attack on, Standing trees	wood specimens, microscopes, culture plates, insect samples or images,

	newly felled logs ii. Seasoned and partly seasoned logs and sawn timber in storage 4.3 Describe the life cycle of wood-destroying insects. 4.4 Describe the signs of insect attack on wood 4.5 Outline the conditions that favour insect attack on wood 4.6 Explain the economic importance of insect damage to wood and timber.	newly felled logs ii. Seasoned and partly seasoned logs and sawn timber in storage • Explain the life cycle of wood-destroying insects • Explain the signs of insect attack on wood • Explain the conditions that favour insect attack on wood • Discuss the economic importance of insect damage to wood and timber	Whiteboard, Marker, etc.	wood-destroying insects. • Identify the signs of insect attack on wood.	and newly felled logs • Identify the life cycle of wood-destroying insects. • Identify the signs of insect attack on wood.	preservatives, test chambers, PPE.
General Objective 5.0: Understand methods of prevention and control of bio deterioration of woods						
13-15	5.1 Explain wood bio deterioration prevention and control and their importance. 5.2 Describe the following methods of prevention and control of wood biodeterioration: Moisture control, Chemical treatment, Natural durability. 5.3 Explain the application of	• Discuss wood bio deterioration prevention and control and their importance • Explain the following methods of prevention and control of wood bio deterioration; Moisture control, Chemical treatment, Natural durability. • Discuss the application of Nanotechnology in the prevention and control	Textbooks, Charts, Computer, Projector, Internet Resources, Journal, Whiteboard, Marker, etc.	• Carry out the following methods of prevention and control of wood bio deterioration; - Moisture control, - Chemical treatment, - Natural durability.	Guide students to: • Carry out the following methods of prevention and control of wood bio deterioration; - Moisture control, - Chemical treatment, - Natural durability.	Wood specimens, microscopes, culture plates, insect samples or images, preservatives, test chambers, PPE.

	nanotechnology in the prevention and control of wood bio deterioration.	of wood bio deterioration.				
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COURSE ASSESSMENT:**Course Work: 10%****Test/Assignments: 10%****Practical: 40%****Examination: 40%****Total: 100%**

PULPING PROCESSES

PROGRAMME: HIGHER NATIONAL DIPLOMA WOOD AND PAPER TECHNOLOGY (WOOD PRODUCTS PROCESSING TECHNOLOGY OPTION)		
COURSE TITLE: PULPING PROCESSES	COURSE CODE: WPT 327	CONTACT HOURS: 3 HOURS/WEEK
	CREDIT UNIT: 3	THEORETICAL: 1HOUR/WEEK
YEAR: I SEMESTER: II	PRE-REQUISITE: NIL	PRACTICAL: 2 HOURS/WEEK
GOAL: This course is designed to equip students with knowledge and skills in the chemistry and technology of pulp manufacture.		
GENERAL OBJECTIVES: On completion of this course, the students should be able to: 1.0 Know the pulp and paper properties of various fibrous raw materials; 2.0 Understand various pulping processes and their principles of operation; 3.0 Understand the processes of pulp purification, bleaching and finishing; 4.0 Understand pulp production in the laboratory.		

PROGRAMME: HIGHER NATIONAL DIPLOMA WOOD AND PAPER TECHNOLOGY (WOOD PRODUCTS PROCESSING TECHNOLOGY OPTION)**COURSE TITLE: PULPING PROCESSES****COURSE CODE: WPT 327****CONTACT HOURS: 3 HOURS/WEEK****CREDIT UNIT: 3****THEORETICAL: 1HOUR/WEEK****YEAR: I SEMESTER: II****PRE-REQUISITE:****PRACTICAL: 2 HOURS/WEEK****COURSE SPECIFICATION: THEORETICAL AND PRACTICAL****GOAL:** This course is designed to equip students with knowledge and skills in the chemistry and technology of pulp manufacture.**GENERAL OBJECTIVE 1.0:** Know the pulp and paper properties of various fibrous raw materials.

THEORETICAL CONTENT				PRACTICAL CONTENT		
Week	Specific Learning Outcome	Teacher's Activities	Resources	Specific Learning Outcome	Teacher's Activities	Resources
1-3	1.1 Describe materials for pulping. 1.2 Describe the similarities, differences and selection criteria relating to hardwood and softwood 1.3 Describe the pulping characteristics of hardwood and softwood.	• Explain materials for pulping. • Discuss the similarities, differences and selection criteria relating to hardwood and softwood. • Explain the pulping characteristics of hardwood and softwood	Textbooks, Charts, Computer, Projector, Internet Resources, Journal, Whiteboard, Marker, etc.	• Identify materials for pulping. • Compare hardwood and softwood. • Demonstrate materials for pulping using the approved procedure and record observations.	Guide students to: • Identify materials for pulping. • Compare hardwood and softwood. • Demonstrate materials for pulping using the approved procedure and record observations.	Fibre Samples, Chipper or Sample Chips, Digester or Autoclave, Refiners, Screens, Laboratory Glassware, Chemicals, Balance, PPE.
General Objective 2.0: Understand various pulping processes and their principles of operation.						
4-7	2.1 Outline pulp-mill operations. 2.2 Explain the impact of wood chip characteristics on pulp	• Outline pulp-mill operations • Explain the impact of wood chip characteristics on pulp	Textbooks, Charts, Computer, Projector, Internet	• Prepare wood raw material for pulping by debarking, splitting, chipping, screening and washing.	Guide students to: • Prepare wood raw material for pulping by debarking, splitting, chipping,	Fibre Samples, Chipper or Sample Chips, Digester or Autoclave,

yield and properties 2.3 Describe mechanical pulping routes and their selection criteria 2.4 Describe semi-chemical and neutral sulphite semi-chemical pulping 2.5 Explain sulphite, soda, and kraft pulping processes 2.6 Explain chemical-recovery objectives and operations in sulphite and kraft pulp mills.	yield and properties • Describe mechanical pulping routes and their selection criteria • Explain semi-chemical and neutral sulphite semi-chemical pulping • Discuss sulphite, soda and kraft pulping processes • Explain the analytical procedure and interpretation of chemical-recovery objectives and operations in sulphite and kraft pulp mills.	Resources, Journal, Whiteboard, Marker, etc.	• Produce a laboratory sample of mechanical pulp using an available grinder or refiner and record operating variables. • Apply a selected chip pre-treatment • Prepare a laboratory semi-chemical under specified liquor and cooking conditions. • Produce a laboratory sulphite, soda or kraft pulp while controlling liquor composition, temperature and cooking time. • Calculate relevant alkali, causticity or sulphidity values • Determine pulp yield and basic quality indices. • Prepare a process-flow diagram for chemical recovery • Propose one closed-loop or green-chemistry improvement.	screening and washing. • Produce a laboratory sample of mechanical pulp using an available grinder or refiner and record operating variables. • Apply a selected chip pre-treatment • Compare the resulting SGW, RMP, TMP or CMP pulp characteristics. • Prepare a laboratory semi-chemical or NSSC pulp under specified liquor and cooking conditions. • Produce a laboratory sulphite, soda or kraft pulp while controlling liquor composition, temperature and cooking time. • Calculate relevant alkali, causticity or sulphidity values • Determine pulp yield and basic	Refiners, Screens, Laboratory Glassware, Chemicals, Balance, PPE.
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					quality indices. • Prepare a process-flow diagram for chemical recovery • Propose one closed-loop or green-chemistry improvement.	
General Objective 3.0 Understand the processes of pulp purification, bleaching and finishing						
8-11	3.1 Describe the pulp purification processes washing and cleaning. 3.2 Explain the aims of pulp purification bleaching and finishing. 3.3 Describe the various bleaching processes. 3.4 Describe the various Pulps finishing processes e.g. lap formation, pressing, drying types and baling. 3.5 Describe pulp purification. 3.6 Describe pulp bleaching. 3.7 Describe pulp finishing.	• Explain the pulp purification processes washing and cleaning. • Discuss the aims of pulp purification bleaching and finishing • Explain the various bleaching processes • Explain the various Pulps finishing processes e.g. lap formation, pressing, drying types and baling • Explain pulp purification. • Explain pulp bleaching with relevant examples, diagrams or case materials. • Explain pulp finishing	Textbooks, Charts, Computer, Projector, Internet Resources, Journal, Whiteboard, Marker, etc.	• Perform purify pulp, Bleach pulp, Finish pulp. • Carry out observation, identification and documentation the pulp purification processes washing and cleaning using the specified criteria. • Demonstrate the aims of pulp purification bleaching and finishing through an assigned practical exercise. • Carry out observation, identification and documentation the various bleaching processes using the specified criteria.	Guide students to: • Perform purify pulp, Bleach pulp, Finish pulp. • Carry out observation, identification and documentation the pulp purification processes washing and cleaning using the specified criteria. • Demonstrate the aims of pulp purification bleaching and finishing through an assigned practical exercise. • Carry out observation, identification and documentation the	Fibre Samples, Chipper or Sample Chips, Digester or Autoclave, Refiners, Screens, Laboratory Glassware, Chemicals, Balance, PPE.

					various bleaching processes using the specified criteria.	
General Objective 4.0 Understand pulp production in the laboratory.						
12-15	4.1 Explain analysis of pulping liquor. 4.2 Describe mill manufacture of chlorine sodium hydroxide, sodium hypochlorite and chlorine dioxide. 4.3 Describe water treatment process and steam generation. 4.4 Describe production of chemical pulp using the autoclave. 4.5 Explain ground wood pulp and chemical pulp by tests. 4.6 Explain chlorine number, kappa number, copper number, and permanganate (KmnO₄) number of pulp.	• Discuss analysis of pulping liquor • Explain mill manufacture of chlorine sodium hydroxide, sodium hypochlorite and chlorine dioxide • Explain water treatment process and steam generation. • Explain production of chemical pulp using the autoclave • Discuss ground wood pulp and chemical pulp by tests. • Discuss chlorine number, kappa number, copper number, and permanganate (KmnO₄) number of pulp.	Textbooks, Charts, Computer, Projector, Internet Resources, Journal, Whiteboard, Marker, etc.	• Analyse pulping liquor. • Prepare pulp samples in the sprout laboratory refiner. • Produce chemical pulp using the autoclave. • Identify ground wood pulp and chemical pulp by tests. • Determine chlorine number, kappa number, copper number, and permanganate (KmnO₄) number of pulp.	Guide students to: • Analyse pulping liquor. • Prepare pulp samples in the sprout laboratory refiner. • Produce chemical pulp using the autoclave. • Identify ground wood pulp and chemical pulp by tests. • Determine chlorine number, kappa number, copper number, and permanganate (KmnO₄) number of pulp.	Fibre Samples, Chipper or Sample Chips, Digester or Autoclave, Refiners, Screens, Laboratory Glassware, Chemicals, Balance, PPE.

COURSE ASSESSMENT:

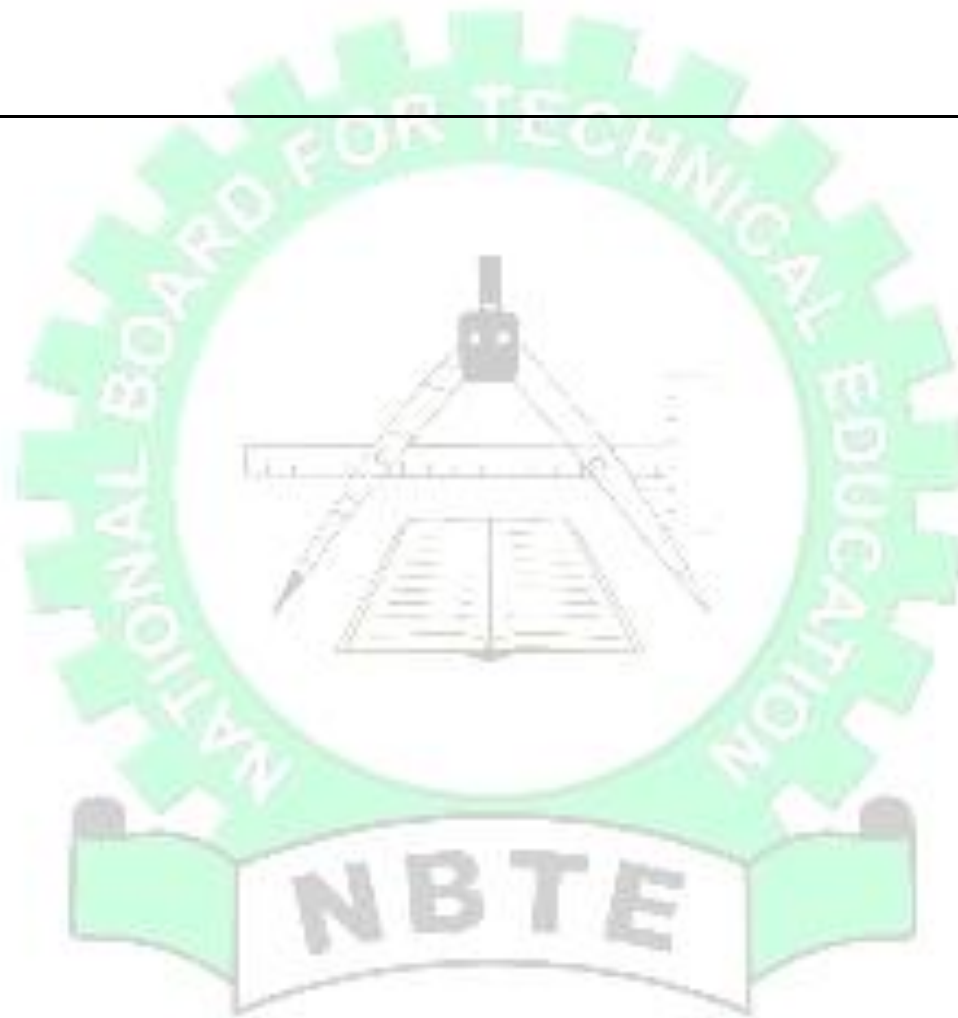
Course Work: 10%

Test/Assignments: 10%

Practical: 40%

Examination: 40%

Total: 100%





YEAR II SEMESTER I

WOOD COMPOSITE AND ENGINEERED WOOD PRODUCTS

PROGRAMME: HIGHER NATIONAL DIPLOMA WOOD AND PAPER TECHNOLOGY (WOOD PRODUCTS PROCESSING TECHNOLOGY OPTION)		
COURSE TITLE: WOOD COMPOSITE AND ENGINEERED WOOD PRODUCTS	COURSE CODE: WPP 411	CONTACT HOURS: 4 HOURS/WEEK
	CREDIT UNIT: 4	THEORETICAL: 1 HOUR/WEEK
YEAR: II SEMESTER: I	PRE-REQUISITE:	PRACTICAL: 3 HOURS/WEEK
GOAL: This course is designed to equip students with knowledge and skills in engineered wood products and wood composite technologies.		
GENERAL OBJECTIVES: On completion of this course, the students should be able to: 1.0 Understand engineered wood products and their industrial applications; 2.0 Understand wood composite materials and production technologies; 3.0 Understand adhesive systems used in wood composites; 4.0 Know the strength of various mechanical fasteners used in the wood industry; 5.0 Know different types of timberbeams and timber columns and their design; 6.0 Understanding the engineering principles in the manufacture of structural sandwich panels and wood bending; 7.0 Understand the various methods of designing wooden structures against fire; 8.0 Understand quality control and performance of engineered wood products; 9.0 Apply wood composite and engineered wood technologies in industrial operations.		

PROGRAMME: HIGHER NATIONAL DIPLOMA WOOD AND PAPER TECHNOLOGY (WOOD PRODUCTS PROCESSING TECHNOLOGY OPTION)						
COURSE TITLE: WOOD COMPOSITE AND ENGINEERED WOOD PRODUCTS			COURSE CODE: WPP 411		CONTACT HOURS: 4 HOURS/WEEK	
			CREDIT UNIT: 4		THEORETICAL: 1 HOUR/WEEK	
YEAR: II SEMESTER: I			PRE-REQUISITE:		PRACTICAL: 3 HOURS/WEEK	
COURSE SPECIFICATION: THEORETICAL AND PRACTICAL						
GOAL: This course is designed to equip students with knowledge and skills in engineered wood products and wood composite technologies.						
GENERAL OBJECTIVE 1.0: Understand engineered wood products and their industrial applications;						
THEORETICAL CONTENT				PRACTICAL CONTENT		
Week	Specific Learning Outcome	Teacher’s Activities	Resources	Specific Learning Outcome	Teacher’s Activities	Resources
1	1.1 Explain engineered wood products and their importance. 1.2 Outline types of engineered wood products: plywood, veneer, laminated wood, particleboard, fibreboard and blockboard. 1.3 Explain properties and applications of engineered wood products. 1.4 Explain advantages and limitations of engineered wood products.	• Explain engineered wood products and their importance. • Explain types of engineered wood products: plywood, veneer, laminated wood, particleboard, fibreboard and blockboard. • Explain properties and applications of engineered wood products. • Explain advantages and limitations of engineered wood products.	White Board, Marker, charts, projector, textbooks, etc.	• Identify different engineered wood products. • Compare physical characteristics of plywood, veneer, particleboard and fibreboard.	Guide student to: • Identify different engineered wood products. Compare physical characteristics of plywood, veneer, particleboard and fibreboard.	Engineered wood samples, identification guide, notebooks, practical manual etc.
General Objective 2.0: Understand wood composite materials and production technologies						

2-3	2.1 Explain wood composite production principles. 2.2 Describe veneer production and plywood manufacturing processes. 2.3 Explain particleboard and fibreboard production methods. 2.4 Explain factors affecting composite quality. 2.5 Explain waste wood utilization in composite production.	• Explain wood composite production principles. Describe veneer production and plywood manufacturing processes. • Discuss particleboard and fibreboard production methods. • Discuss factors affecting composite quality. • Explain waste wood utilization in composite production.	White Board, Marker, charts, projector, textbooks, etc.	• Observe veneer preparation and plywood layering process. • Produce simple wood composite board using sawdust/wood particles and binder. • Compare composite boards prepared from different materials.	Guide student to; • Observe veneer preparation and plywood layering process. • Produce simple wood composite board using sawdust/wood particles and binder. • Compare composite boards prepared from different materials.	Sawdust, wood particles, mould, pressing tools, binder, PPE, practical manual etc.
General Objective 3.0: Understand adhesive systems used in wood composites						
4-5	3.1 Explain the theory of adhesion 3.2 Explain types adhesives used in wood industries. 3.3 Describe characteristics and functions of wood adhesives. 3.4 Describe the manufacture, preparation and application of various adhesives. 3.5 Explain adhesive application methods in composite production. 3.6 Describe quality control	• Describe the theory of adhesion • Describe types adhesives used in wood industries. • Discuss characteristics and functions of wood adhesives. • Explain the manufacture, preparation and application of various adhesives. • Discuss adhesive application methods in composite production.	White Board, Marker, charts, projector, textbooks, etc.	• Prepare adhesives for simple wood composite production. • Compare bonding performance of selected adhesives. • Demonstrate safe handling and PPE use during adhesive application. • Draw different joints made with adhesives, bolts, screws and gusset plates • Construct joints using adhesives bolts, screws	Guide student to: • Prepare adhesives for simple wood composite production. • Compare bonding performance of selected adhesives. • Demonstrate safe handling and PPE use during adhesive application. • Draw different joints made with adhesives, bolts, screws and gusset	Adhesives, brushes, gloves, goggles, timber pieces, PPE, practical manual.

	measures during the making of gluejoints. 3.7 Explain safety precautions in adhesive handling. 3.8 Describe different joints made with adhesives, bolts, screws and gusset plates. 3.9 Describe construction of joints using adhesives bolts, screws and gusset plates 3.10 Describe Testing the Loading capacities of the joint constructed in 3.8 above	• Describe quality control measures during the making of gluejoints. • Discuss safety precautions in adhesive handling. • Describe different joints made with adhesives, bolts, screws and gusset plates. • Explain construction of joints using adhesives bolts, screws and gusset plates • Discuss Testing the Loading capacities of the joint constructed in 3.8 above		and gusset plates • Test the Loading capacities of the joint constructed in 3.8	plates • Construct joints using adhesives bolts, screws and gusset plates • Test the Loading capacities of the joint constructed in 3.8	
General Objective 4.0: Know the strength of various mechanical fasteners used in the wood industry.						
6-7	4.1 Explain the loading capabilities of nailed, spiked, Staples, screwed and bolted joints. 4.2 Describe the main features of connectors (split rings, shear plates and toothed plates) gang nails and factors governing the strengths of joint made with them. 4.3 Explain the calculation	• Explain the loading capabilities of nailed, spiked, Staples, screwed and bolted joints. • Discuss the main features of connectors (split rings, shear plates and toothed plates) gang nails and factors governing the strengths of joint	White Board, Marker, charts, projector, textbooks, etc.	• Identify mechanical fasteners • Join wood using mechanical fasteners • Calculate the loading capacities of joints in 2.2 above for Lateval, with drawals, and shear loadings (single and double-shear) under Nigeria code of Practice for short,	Guide student to: • Identify mechanical fasteners • Join wood using mechanical fasteners • Calculate the loading capacities of joints in 2.2 above for Lateval, with drawals, and shear loadings (single and double-shear) under	Nails, Spike, Staples, Screwe Bolt joints.

	of loading capacities of joints in 2.2 above for Lateval, with drawals, and shear loadings (single and double-shear) under Nigeria code of Practice for short, medium, and Long term loading conditions. 4.4 Explain the calculation using Hankinson's formular. 4.5 Describe Joining wood using mechanical fasteners	made with them. • Discuss the calculation of the loading capacities of joints in 2.2 above for Lateval, with drawals, and shear loadings (single and double-shear) under Nigeria code of Practice for short, medium, and Long term loading conditions. • Discuss the calculation of load using Hankinson's formular. • Explain Joining wood using mechanical fasteners		medium, and Long term loading conditions. • Calculate load using Hankinson's formular.	Nigeria code of Practice for short, medium, and Long term loading conditions. • Calculate load using Hankinson's formular	
General Objective 5.0: Know different types of timberbeams and timber columns and their design.						
8-9	5.1 Explain the terms beams, loads, structure, and stress. locating capacity, shear force diagram, bending moment as used in beam design. 5.2 Describe different types of timber beams and their applications. 5.3 Describe design of simple-supported beams using the three design	• Describe the terms beams, loads, structure, and stress. locating capacity, shear force diagram, bending moment as used in beam design. • Explain different types of timber beams and their applications. • Explain design of simple-supported	White Board, Marker, charts, projector, textbooks, etc.	• Design simple-supported beams using the three design criteria (shear, deflection and bending strength criteria) and applying the Nigerian Design code of Practice for timber engineering. • Design long and short timber columns applying the modified	Guide student to: Design simple-supported beams using the three design criteria (shear, deflection and bending strength criteria) and applying the Nigerian Design code of Practice for timber engineering. Design long and short	Timber logs

	criteria (shear, deflection and bending strength criteria) and applying the Nigerian Design code of Practice for timber engineering. 5.4 Define the terms, Columns, Posts, Struts, Buckling, Compression, Slenderness ratio, etc. as used in columns design. 5.2 Describe the different types of timber columns and their loading capacities. 5.1 Explain the derivation and modification of the Evler's formular $P = \frac{EA\pi^2}{S^2}$ where P is the maximum compressive load on column, E is modulus of Elasticity; A the area of cross-section and S, the slenderness ratio of the column. 5.2 Describe design of long and short timber columns applying the modified Eulers formular.	beams using the three design criteria (shear, deflection and bending strength criteria) and applying the Nigerian Design code of Practice for timber engineering. • Discuss the terms, Columns, Posts, Struts, Buckling, Compression, Slenderness ratio, etc. as used in columns design. • Describe the different types of timber columns and their loading capacities. • Discuss the derivation and modification of the Evler's formular $P = \frac{EA\pi^2}{S^2}$ where P is the maximum compressive load on column, E is modulus of Elasticity; A the area of cross-section and S, the slenderness ratio of the column. • Explain design of long and short timber columns applying the modified Eulers		Eulers formular.	timber columns applying the modified Eulers formular.	
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		formular.				
General Objective 6.0: Understanding the engineering principles in the manufacture of structural sandwich panels and wood bending						
10-11	6.1 Explain stressed-skin panel, hollow core and structural sandwich panels. 6.2 Describe the process of the manufacture of structural sandwich panels 6.3 Explain application of the process in 6.2 above in the making of sandwich panels. 6.4 Describe the main feature and uses of glued-laminated members. 6.5 Differentiate glued-laminated members from those of plywood. 6.6 Explain principles of bending veneered-curved members (glued-laminated member — or glulam) 6.7 Describe the uses of 6.6 above. 6.8 Describe techniques of making (i) bent plywood with veneers bent and glued	• Explain stressed-skin panel, hollow core and structural sandwich panels. • Explain the process of the manufacture of structural sandwich panels • Explain application of the process in 6.2 above in the making of sandwich panels • Explain the main feature and uses of glued-laminated members. • Differentiate glued-laminated members from those of plywood. • Explain principles of bending veneered-curved members (glued-laminated member — or glulam) • Explain the uses of 6.6 above. • Explain techniques of making (i) bent plywood with veneers bent and glued	White Board, Marker, charts, projector, textbooks, etc.	• Apply the process in 6.2 above in the making of sandwich panels. • apply principles of bending veneered-curved members (glued-laminated member — or glulam) • Produce (i) bent plywood with veneers bent and glued simultaneously; (ii) plywood bent after gluing. • Design bent wooden members, using solid and flexible wood insertion and the method of kerfing. • Construct bent wooden members, using solid and flexible wood insertion and the method of kerfing.	Guide student to: • Apply the process in 6.2 above in the making of sandwich panels. • apply principles of bending veneered-curved members (glued-laminated member — or glulam) • Produce (i) bent plywood with veneers bent and glued simultaneously; (ii) plywood bent after gluing. • Design bent wooden members, using solid and flexible wood insertion and the method of kerfing. • Construct bent wooden members, using solid and flexible wood insertion and the method of kerfing.	Timber logs

	simultaneously; (ii) plywood bent after gluing. 6.9 Describe steps in the plasticizing of solid wood for bending. 6.10 Describe design and construction of bent wooden members, using solid and flexible wood insertion and the method of kerfing. 6.11 Explain the advantages of the bent wood members over carved (i.e. sawn) bent members.	simultaneously; (ii) plywood bent after gluing. • Explain steps in the plasticizing of solid wood for bending. • Explain design and construction of bent wooden members, using solid and flexible wood insertion and the method of kerfing. • Explain the advantages of the bent wood members over carved (i.e. sawn) bent members.				
General Objective 7.0: Understand the various methods of designing wooden structures against fire.						
12-13	7.1 Describe the effects of fire on various wooden structures. 7.2 Describe the effects of fire on wooden structures with those on other structures (such as steel, concrete etc). 7.3 Describe various timber structures designed against fire and evaluate their performance.	• Discuss the effects of fire on various wooden structures. • Explain the effects of fire on wooden structures with those on other structures (such as steel, concrete etc). • Discuss various timber structures designed against fire and evaluate their performance.	White Board, Marker, charts, projector, textbooks, etc.	• Identify various timber structures designed against fire • Evaluate their performance.	Guide student to: • Identify various timber structures designed against fire • Evaluate their performance.	Timber logs Steel Concrete structures
General Objective 8.0: Understand quality control and performance of engineered wood products						

14	8.1 Explain quality requirements for engineered wood products. 8.2 Describe common defects in composite materials. 8.3 Explain testing methods for composite products. 8.4 Describe durability and performance of engineered wood products.	• Discuss quality requirements for engineered wood products. • Explain common defects in composite materials. • Discuss testing methods for composite products. • Explain durability and performance of engineered wood products.	White Board, Marker, charts, projector, textbooks, etc.	• Identify defects in engineered wood products. • Compare strength and durability of selected composite products. • Assess bonding quality and surface finish.	Guide student to: • Identify defects in engineered wood products. • Compare strength and durability of selected composite products. • Assess bonding quality and surface finish.	Composite samples, inspection checklist, workshop tools, practical manual etc.
General Objective 9.0: Apply wood composite and engineered wood technologies in industrial operations						
15	9.1 Explain industrial applications of engineered wood products. 9.2 Explain quality control systems in composite industries. 9.3 Describe waste reduction practices in composite production. 9.4 Explain emerging trends in engineered wood technologies.	Explain industrial applications of engineered wood products. Discuss quality control systems in composite industries. Explain waste reduction practices in composite production. Describe emerging trends in engineered wood technologies.	White Board, Marker, charts, projector, textbooks, etc.	• Visit plywood, furniture or composite manufacturing facility and observe production processes. • Assess quality of engineered wood products. • Identify waste utilization practices in industry.	Guide student to: • Visit plywood, furniture or composite manufacturing facility and observe production processes. • Assess quality of engineered wood products. • Identify waste utilization practices in industry.	Plywood/composite plant, notebooks, transport, practical manual etc.
COURSE ASSESSMENT: Course Work: 10% Test/Assignments: 10% Practical: 40%						

Examination:	40%
Total:	100%



WOOD FINISHING, ADHESIVES AND SURFACE COATING TECHNOLOGY

PROGRAMME: HIGHER NATIONAL DIPLOMA WOOD AND PAPER TECHNOLOGY (WOOD PRODUCTS PROCESSING TECHNOLOGY OPTION)		
COURSE TITLE: WOOD FINISHING, ADHESIVES AND SURFACE COATING TECHNOLOGY	COURSE CODE: WPP 412	CONTACT HOURS: 4 HOURS/WEEK
	CREDIT UNIT: 4	THEORETICAL: 1 HOUR/WEEK
YEAR: II SEMESTER: I	PRE-REQUISITE:	PRACTICAL: 3 HOURS/WEEK
GOAL: This course is designed to equip students with knowledge and skills in wood finishing and industrial applications.		
GENERAL OBJECTIVES: On completion of this course, the students should be able to: 1.0 Understand wood surface preparation and finishing principles; 2.0 Know adhesive systems and bonding techniques in wood products; 3.0 Comprehend wood finishing and surface coating technologies; 4.0 Understand finishing defects, quality assessment and corrective measures; 5.0 Know industrial wood finishing and coating practices.		

PROGRAMME: HIGHER NATIONAL DIPLOMA WOOD AND PAPER TECHNOLOGY (WOOD PRODUCTS PROCESSING TECHNOLOGY OPTION)						
COURSE TITLE: WOOD FINISHING, ADHESIVES AND SURFACE COATING TECHNOLOGY				COURSE CODE: WPP 412		CONTACT HOURS: 4 HOURS/WEEK
				CREDIT UNIT: 4		THEORETICAL: 1 HOUR/WEEK
YEAR: II SEMESTER: I				PRE-REQUISITE:		PRACTICAL: 3 HOURS/WEEK
COURSE SPECIFICATION: THEORETICAL AND PRACTICAL						
GOAL: This course is designed to equip students with knowledge and skills in wood finishing and industrial applications.						
GENERAL OBJECTIVE 1.0: Understand wood surface preparation and finishing principles						
THEORETICAL CONTENT				PRACTICAL CONTENT		
Week	Specific Learning Outcome	Teacher’s Activities	Resources	Specific Learning Outcome	Teacher’s Activities	Resources
1–3	1.1 Explain principles and importance of wood finishing. 1.2 Describe wood surface preparation techniques. 1.3 Explain sanding, smoothing and cleaning procedures. 1.4 Explain selection of finishing materials for wood products. 1.5 Explain safety precautions in finishing operations.	- Explain principles and importance of wood finishing. - Explain wood surface preparation techniques. - Describe sanding, smoothing and cleaning procedures. - Discuss selection of finishing materials for wood products. - Discuss safety precautions in finishing operations.	White Board, Marker, charts, projector, textbooks, etc.	- Prepare wood surfaces through sanding and smoothing techniques. - Compare prepared and unprepared wood surfaces. - Select appropriate finishing materials for different wood products. - Demonstrate safe handling of finishing materials.	Guide student to: - Prepare wood surfaces through sanding and smoothing techniques. - Compare prepared and unprepared wood surfaces. - Select appropriate finishing materials for different wood products. - Demonstrate safe handling of finishing materials.	Timber samples, sandpaper, sanding machine, PPE, finishing materials, practical manual etc.
General Objective 2.0: Know adhesive systems and bonding techniques in wood products.						
4–6	2.1 Outline types of wood adhesives and their properties.	Explain types of wood adhesives and their properties.	White Board, Marker, charts,	Prepare and apply adhesives for wood joints.	Guide student to: Prepare and apply adhesives for wood	Adhesives, timber pieces, clamps,

	2.2 Explain adhesive selection criteria for wood products. 2.3 Describe bonding principles and adhesive application methods. 2.4 Explain factors affecting bonding quality.	• Explain adhesive selection criteria for wood products. • Discuss bonding principles and adhesive application methods. • Describe factors affecting bonding quality.	projector, textbooks, etc.	• Compare bonding strength of selected adhesives. • Carry out simple bonding test using wood joints.	joints. • Compare bonding strength of selected adhesives. • Carry out simple bonding test using wood joints.	brushes, PPE, workshop tools, practical manual etc.
General Objective 3.0: Apply wood finishing and surface coating technologies.						
7–10	3.1 Explain wood finishing materials: paints, varnishes, lacquers, sealants and stains. 3.2 Describe coating methods: brushing, spraying, dipping and polishing. 3.3 Explain drying and curing processes. 3.4 Describe industrial finishing workflow.	• Explain wood finishing materials: paints, varnishes, lacquers, sealants and stains. • Discuss coating methods: brushing, spraying, dipping and polishing. • Describe drying and curing processes. • Explain industrial finishing workflow.	White Board, Marker, charts, projector, textbooks, etc.	• Apply paint, varnish, stain and polish to selected wood products. • Compare finished surfaces based on smoothness and appearance. • Prepare finishing record sheet for treated wood products.	Guide students to: • Apply paint, varnish, stain and polish to selected wood products. • Compare finished surfaces based on smoothness and appearance. • Prepare finishing record sheet for treated wood products.	Paints, varnish, spray equipment, brushes, PPE, timber samples, practical manual etc.
General Objective 4.0: Understand finishing defects, quality assessment and corrective measures.						
11–13	4.1 Explain common finishing defects in wood products. 4.2 Describe causes of finishing defects. 4.3 Explain methods for correcting finishing defects.	• Discuss common finishing defects in wood products. • Discuss causes of finishing defects. • Explain methods for correcting finishing defects.	White Board, Marker, charts, projector, textbooks, etc.	• Identify defects such as blistering, peeling, roughness and uneven coating. • Correct selected finishing defects on wood surfaces. • Assess quality of	Guide student to: • Identify defects such as blistering, peeling, roughness and uneven coating. • Correct selected finishing defects on wood surfaces.	

	4.4 Describe quality standards for finished wood products.	• Discuss quality standards for finished wood products.		finished products using checklist.	• Assess quality of finished products using checklist.	
General Objective 5.0: Apply industrial wood finishing and coating practices,						
14–15	5.1.Explain industrial finishing systems and workflow. 5.2.Explain safety and environmental considerations in finishing industries. 5.3.Explain quality assurance practices in finishing operations. 5.4.Explain emerging trends in wood coating technologies.	• Discuss industrial finishing systems and workflow. • Explain safety and environmental considerations in finishing industries. • Discuss quality assurance practices in finishing operations. • Describe emerging trends in wood coating technologies.	White Board, Marker, charts, projector, textbooks, etc.	• Visit furniture finishing workshop or wood coating facility and assess finishing operations. • Evaluate quality of finished products. • Observe industrial adhesive and coating systems.	Guide student to: • Visit furniture finishing workshop or wood coating facility and assess finishing operations. • Evaluate quality of finished products. • Observe industrial adhesive and coating systems.	Furniture workshop/coating facility, notebooks, transport, practical manual etc.
COURSE ASSESSMENT: Course Work: 10% Test/Assignments: 10% Practical: 40% Examination: 40% Total: 100%						

WOOD YARD OPERATIONS AND MATERIAL HANDLING

PROGRAMME: HIGHER NATIONAL DIPLOMA WOOD AND PAPER TECHNOLOGY (WOOD PRODUCTS PROCESSING TECHNOLOGY OPTION)		
COURSE TITLE: WOOD YARD OPERATIONS AND MATERIAL HANDLING	COURSE CODE: WPP 413	CONTACT HOURS: 3 HOURS/WEEK
	CREDIT UNIT:3	THEORETICAL: 1 HOUR/WEEK
YEAR: II SEMESTER: I	PRE-REQUISITE:	PRACTICAL:2 HOURS/WEEK
GOAL: This course is designed to provide student with the knowledge and skills on principles and techniques of materials handling and other wood yard operations.		
GENERAL OBJECTIVES: On completion of this course, the students should be able to: 1.0 Understand the principles involved in organizing a log yard; 2.0 Understand the nature of operations and the equipment used in the various wood yards; 3.0 Know digital technologies for wood yard inventory management; 4.0 Understand occupational health, safety and environmental regulations in wood yard operations.		



PROGRAMME: HIGHER NATIONAL DIPLOMA WOOD AND PAPER TECHNOLOGY (WOOD PRODUCTS PROCESSING TECHNOLOGY OPTION)						
COURSE TITLE: WOOD YARD OPERATIONS AND MATERIAL HANDLING			COURSE CODE: WPP 413		CONTACT HOURS: 3 HOURS/WEEK	
			CREDIT UNIT:3		THEORETICAL: 1 HOUR/WEEK	
YEAR: II SEMESTER: I			PRE-REQUISITE:		PRACTICAL:2 HOURS/WEEK	
COURSE SPECIFICATION: THEORETICAL AND PRACTICAL						
GOAL: This course is designed to provide student with the knowledge and skills on principles and techniques of materials handling and other wood yard operations.						
GENERAL OBJECTIVE 1.0: Understand the principles involved in organizing a log yard.						
THEORETICAL CONTENT				PRACTICAL CONTENT		
Week	Specific Learning Outcome	Teacher’s Activities	Resources	Specific Learning Outcome	Teacher’s Activities	Resources
1-3	1.1 Explain the function and importance of wood yard operations in forest industries 1.2 List the factors determining the design of a log yard e.g. the quantity of materials to be handled; equipment to be used; availability of land; height and nature of stack; cost etc. 1.3 Explain the factors determining the quantity of materials to be handled; equipment to be used; availability of land; height and nature of stack;	• Discuss the function and importance of wood yard operations in forest industries • State the factors determining the design of a log yard e.g. the quantity of materials to be handled • Discuss the factors determining the quantity of materials to be handled; equipment to be used; availability of land; height and nature of stack; cost etc • Explain the importance of good yard	White Board, Marker, charts, projector, textbooks, etc.	• Calculate the area and productivity of a yard • Design a typical logyard/raw material yard, for the production of particleboard, fibreboard, sawmill, plymill a paper mill and a downstream paper industry • Design a comprehensive wood yard operations management plan for a wood and paper industries, and forestry industries.	Guide student to: • Calculate the area and productivity of a yard • Design a typical logyard/raw material yard, for the production of particleboard, fibreboard, sawmill, plymill a paper mill and a downstream paper industry • Design a comprehensive wood yard operations	Design books

	cost etc. 1.4 Describe the importance of good yard cementing and tarring; adequate drainage and access roads in log yard construction. 1.5 Explain the importance of productivity and efficiency in wood yard operation. 1.6 Explain the following productivity and efficiency indicators in wood yard operation. - KPIs - Throughput analysis - Operational efficiency metrics 1.6 Describe the calculation of the area and productivity of a yard. 1.7 Explain the effects of handling on the productivity of the industry. 1.8 Describe design a typical logyard/raw material yard, for the production of particleboard, fibreboard, sawmill, plymill and a paper mill. 1.9 Explain wood yard operations management plan	cementing and tarring; adequate drainage and access roads in log yard construction. - Discuss the calculation of the area and productivity of a yard. - Explain the effects of handling on the productivity of the industry. - Explain design a typical logyard/raw material yard, for the production of particleboard, fibreboard, sawmill, plymill and a paper mill. - Explain wood yard operations management plan - Explain the importance of wood yard operations management plan in forest industries		Calculate and interpret productivity indicators	management plan for a wood and paper industries, and forestry industries. Calculate and interpret productivity indicators	
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	1.10 Describe the importance of wood yard operations management plan in forest industries					
General Objective 2.0: Understand the nature of operations and the equipment used in the various wood yards						
4-8	2.1 Describe the types of raw materials used in various wood factories. 2.2 Explain procedures for receiving, measuring and documenting logs 2.3 Explain sorting, grading and stacking techniques in wood yard operation 2.4 Explain the importance of the techniques in 1.5 above to wood yard operations. 2.5 Describe the factors determining the choice of equipment in log yard e.g. nature of operation productivity, and cost of equipment etc. 2.6 Describe the use of the following equipment in material handling, belt and chair conveyors, elevators, cranes, industrial trucks etc. 2.7 Describe the use of pallets in material handling. 2.8 Describe preventive maintenance on wood	• Explain the types of raw materials used in various wood factories. • Discuss procedures for receiving, measuring and documenting logs • Explain sorting, grading and stacking techniques in wood yard operation • Discuss the importance of the techniques in 1.5 above in wood yard operations. • Describe the factors determining the choice of equipment in log yard e.g. nature of operation productivity, and cost of equipment etc. • Discuss the use of the following equipment in material handling, belt and chair conveyors, elevators, cranes, industrial trucks etc • Explain the use of pallets in material	White Board, Marker, charts, projector, textbooks, etc.	• Identify types of raw materials used in various wood factories. • Demonstrate log scaling and inventory and inventory documentation techniques • Conduct log measurement and record data • Carry out sorting, grading and stacking wood in a wood yard • Operate wood handling equipment • Carry out maintenance on wood handling equipment	Guide student to: • Identify types of raw materials used in various wood factories. • Demonstrate log scaling and inventory and inventory documentation techniques • Conduct log measurement and record data • Carry out sorting, grading and stacking wood in a wood yard • Operate wood handling equipment • Carry out maintenance on wood handling equipment	wood handling equipment Tool box Measuring tapes Calipers Digital inventory software's Maintenance manuals Maintenance log book

	handling equipment 2.9 Explain sustainable forestry logistics and waste reduction technique in wood yard operations	handling • Discuss preventive maintenance on wood handling equipment • Describe sustainable forestry logistics and waste reduction technique in wood yard operations				
General Objective 3.0: Know digital technologies for wood yard inventory management.						
9-12	3.1 Describe digital technologies in wood yard operations 3.2 Explain the importance of digital technologies in wood yard inventory management 3.3 Explain the following digital management tools; i. RFID ii. Barcode systems iii. IoT sensors iv. Inventory softwares 3.4 Describe simulation of inventory tracking activities	• Explain digital technologies in wood yard operations • Describe the importance of digital technologies in wood yard inventory management • Discuss the following digital management tools • Explain simulation of inventory tracking activities	Charts Projector	• Identify wood yard digital technology tools • Carry out simulation of inventory tracking activities	Guide student to: • Identify wood yard digital technology tools • Carry out simulation of inventory tracking activities	Computers Inventory soft wares RFID devices
General Objective 4.0: Understand occupational health, safety and environmental regulations in wood yard operations						
13-15	4.1 Describe the safety precautions necessary in a Log yard. 4.2 State the various safety precautions in the use of equipment in the wood	• Explain the safety precautions necessary in a Log yard. • Outline the various safety precautions in	Safety Charts Projector	• Demonstrate safety precaution in the use of equipment in the wood yard. • Conduct risk	Guide student to: • Demonstrate safety precaution in the use of equipment in the wood yard.	PPE Safety manuals

	yard. 4.3 Explain the various safety precautions in the use of equipment in the wood yard. 4.4 Explain the followings; i. Safety standard ii. Hazard identification iii. Risk control measures.	the use of equipment in the wood yard. • Explain the various safety precautions in the use of equipment in the wood yard. • Explain the followings; - Safety standard - Hazard identification - Risk control measures.		assessments and safety drills • Conduct risk assessments and safety drills.	
COURSE ASSESSMENT: Course Work: 10% Test/Assignments: 10% Practical: 40% Examination: 40% Total: 100%					

WOOD PRODUCTS TESTING AND QUALITY ASSURANCE

PROGRAMME: HIGHER NATIONAL DIPLOMA WOOD AND PAPER TECHNOLOGY (WOOD PRODUCTS PROCESSING TECHNOLOGY OPTION)

COURSE TITLE: WOOD PRODUCTS TESTING AND QUALITY ASSURANCE	COURSE CODE: WPP 414	CONTACT HOURS: 4 HOURS/WEEK
	CREDIT UNIT: 4	THEORETICAL: 1 HOUR/WEEK
YEAR: II SEMESTER: I	PRE-REQUISITE:	PRACTICAL: 3 HOURS/WEEK

GOAL: This course is designed to equip students with knowledge and skills in wood product testing, quality inspection, standards compliance and quality assurance systems.

GENERAL OBJECTIVES: On completion of this course, the students should be able to:

- 1.0 Understand principles of wood products testing and quality assurance;
- 2.0 Comprehend physical and mechanical testing techniques for wood products;
- 3.0 Know quality inspection and defect analysis techniques;
- 4.0 Understand quality standards, documentation and reporting systems;
- 5.0 Know industrial quality assurance practices in wood industries.

PROGRAMME: HIGHER NATIONAL DIPLOMA WOOD AND PAPER TECHNOLOGY (WOOD PRODUCTS PROCESSING TECHNOLOGY OPTION)						
COURSE TITLE: WOOD PRODUCTS TESTING AND QUALITY ASSURANCE				COURSE CODE: WPP 414		CONTACT HOURS: 4 HOURS/WEEK
				CREDIT UNIT: 4		THEORETICAL: 1 HOUR/WEEK
YEAR: II SEMESTER: I				PRE-REQUISITE:		PRACTICAL:3 HOURS/WEEK
COURSE SPECIFICATION: THEORETICAL AND PRACTICAL						
GOAL: This course is designed to equip students with knowledge and skills in wood product testing, quality inspection, standards compliance and quality assurance systems.						
GENERAL OBJECTIVE 1.0: Understand principles of wood products testing and quality assurance						
THEORETICAL CONTENT				PRACTICAL CONTENT		
Week	Specific Learning Outcome	Teacher’s Activities	Resources	Specific Learning Outcome	Teacher’s Activities	Resources
1–3	1.1 Explain principles of wood product testing and quality assurance. 1.2 Describe quality characteristics of wood products. 1.3 Explain industrial quality assurance systems. 1.4 Describe testing procedures for wood products.	• Discuss principles of wood product testing and quality assurance. • Explain quality characteristics of wood products. • Discuss industrial quality assurance systems. • Explain testing procedures for wood products.	White Board, Marker, charts, projector, textbooks, etc.	• Identify quality parameters of selected wood products. • Prepare simple testing checklist for timber, furniture and panel products. • Compare acceptable and defective wood products.	Guide students to: • Identify quality parameters of selected wood products. • Prepare simple testing checklist for timber, furniture and panel products. • Compare acceptable and defective wood products.	Moisture meter, measuring tools, timber samples, furniture samples, adhesive joints, practical manual
General Objective 2.0: Comprehend physical and mechanical testing techniques for wood products						
4-6	2.1 Explain physical testing of wood products: moisture content, dimensions, density and surface quality.	• Discuss physical testing of wood products: moisture content, dimensions, density and surface	White Board, Marker, charts, projector,	• Determine moisture content of selected wood products. • Measure dimensional accuracy of timber and	• Guide students to: • Determine moisture content of selected wood products. • Measure dimensional	Moisture meter, measuring tools, timber

	2.2 Describe mechanical testing of wood products: hardness, strength, flexibility and bonding performance. 2.3 Explain testing of engineered wood products and furniture components. 2.4 Describe factors affecting product performance.	quality. • Explain mechanical testing of wood products: hardness, strength, flexibility and bonding performance. • Discuss testing of engineered wood products and furniture components. • Discuss factors affecting product performance.	textbooks, etc.	furniture products. • Compare strength and flexibility of selected wood samples. • Assess adhesive bond quality of joints and composite products.	accuracy of timber and furniture products. • Compare strength and flexibility of selected wood samples. • Assess adhesive bond quality of joints and composite products.	samples, furniture samples, adhesive joints, practical manual
General Objective 3.0: Know quality inspection and defect analysis techniques.						
7–9	3.1 Explain common defects in timber, furniture and wood products. 3.2 Describe causes of production and finishing defects. 3.3 Explain defect prevention and corrective measures. 3.4 Describe inspection procedures in wood industries.	• Explain common defects in timber, furniture and wood products. • Discuss Explain causes of production and finishing defects. Describe defect prevention and corrective measures. • Explain inspection procedures in wood industries.	White Board, Marker, charts, projector, textbooks, etc.	• Inspect timber, furniture and wood products for defects. • Classify defects based on severity and impact on quality. • Recommend corrective measures for identified defects.	Guide students to: • Inspect timber, furniture and wood products for defects. • Classify defects based on severity and impact on quality. • Recommend corrective measures for identified defects.	Defective samples, inspection sheets, workshop tools, practical manual etc.
General Objective 4.0: Understand quality standards, documentation and reporting systems						
10–12	4.1 Explain quality standards for wood products. 4.2 Describe inspection documentation and	• Describe quality standards for wood products. • Discuss inspection documentation and	White Board, Marker, charts, projector,	• Prepare quality inspection report for selected wood products. • Develop quality	Guide students to; • Prepare quality inspection report for selected wood products.	Quality forms, reporting templates, computer

	reporting systems. 4.3 Explain product traceability and quality records. 4.4 Describe quality compliance requirements.	reporting systems. • Discuss product traceability and quality records. • Explain quality compliance requirements.	textbooks, etc.	checklist for furniture or timber production.	• Develop quality checklist for furniture or timber production.	(where available), practical manual etc.
General Objective 5.0: Know industrial quality assurance practices in wood industries						
13-15	5.1 Describe industrial quality assurance workflow in wood industries. 5.2 Explain quality monitoring systems in production. 5.3 Explain emerging trends in wood product testing and QA. 5.4 Describe supervisory roles in quality control systems.	• Explain industrial quality assurance workflow in wood industries. • Describe quality monitoring systems in production. • Discuss emerging trends in wood product testing and QA. • Explain supervisory roles in quality control systems.	White Board, Marker, charts, projector, textbooks, etc.	• Visit furniture workshop, sawmill or wood processing facility • Assess QA practices. • Conduct quality inspection of selected products.	Guide students to: • Visit furniture workshop, sawmill or wood processing facility • Assess QA practices. • Conduct quality inspection of selected products.	Sawmill/furniture workshop/wood processing facility, notebooks, transport, practical manual etc.
COURSE ASSESSMENT:						
Course Work: 10% Test/Assignments: 10% Practical: 40% Examination: 40% Total: 100%						

COMPUTER-AIDED DESIGN [CAD] FOR WOOD PRODUCTS.

PROGRAMME: HIGHER NATIONAL DIPLOMA WOOD AND PAPER TECHNOLOGY (WOOD PRODUCTS PROCESSING TECHNOLOGY OPTION)		
COURSE TITLE: COMPUTER -AIDED DESIGN [CAD] FOR WOOD PRODUCTS.	COURSE CODE: WPP 415	CONTACT HOURS: 4 HOURS/WEEK
	CREDIT UNIT: 4	THEORETICAL: 1 HOUR/WEEK
YEAR: HND II SEMESTER: I	PRE-REQUISITE:	PRACTICAL: 3 HOURS/WEEK
GOAL: This course is designed to equip students with knowlwdgw and skills in computer-aided design, digital drafting and working drawing preparation for furniture and wood product design.		
GENERAL OBJECTIVES: On completion of this course, the students should be able to: 1.0 Understand principles and applications of CAD in wood product industries; 2.0 Know digital drafting and technical drawing techniques; 3.0 Comprehend CAD tools in furniture and wood products design; 4.0 Apply CAD for production planning and workshop documentation; 5.0 Apply CAD technologies in industrial wood product development.		

PROGRAMME: HIGHER NATIONAL DIPLOMA WOOD AND PAPER TECHNOLOGY (WOOD PRODUCTS PROCESSING TECHNOLOGY OPTION)						
COURSE TITLE: COMPUTER -AIDED DESIGN [CAD] FOR WOOD PRODUCTS.			COURSE CODE: WPP 415		CONTACT HOURS: 4 HOURS/WEEK	
			CREDIT UNIT: 4		THEORETICAL: 1 HOUR/WEEK	
YEAR: HND II SEMESTER: I			PRE-REQUISITE:		PRACTICAL: 3 HOURS/WEEK	
COURSE SPECIFICATION: THEORETICAL AND PRACTICAL						
GOAL: This course is designed to equip students with knowlwdgw and skills in computer-aided design, digital drafting and working drawing preparation for furniture and wood product design.						
GENERAL OBJECTIVE 1.0: Understand principles and applications of CAD in wood product industries						
THEORETICAL CONTENT				PRACTICAL CONTENT		
Week	Specific Learning Outcome	Teacher’s Activities	Resources	Specific Learning Outcome	Teacher’s Activities	Resources
1–3	1.1 Explain concepts and importance of CAD in wood industries. 1.2 Describe applications of CAD in furniture and wood product manufacturing. 1.3 Outline CAD software and digital tools used in wood industries. 1.4 Explain benefits and limitations of CAD systems.	• Describe concepts and importance of CAD in wood industries. • Explain applications of CAD in furniture and wood product manufacturing. • Discuss CAD software and digital tools used in wood industries. • Describe benefits and limitations of CAD systems.	White Board, Marker, charts, projector, textbooks, etc.	• Navigate CAD software environment. • Identify major CAD interface tools and functions. • Create simple CAD workspace files. • Save simple CAD workspace files.	Guide student to: • Navigate CAD software environment. • Identify major CAD interface tools and functions. • Create simple CAD workspace files. • Save simple CAD workspace files.	Computer laboratory, CAD software, internet access (where available), practical manual etc.
General Objective 2.0: Know digital drafting and technical drawing techniques						
4–6	2.1 Explain digital drafting principles and standards. 2.2 Describe orthographic projection and dimensioning in CAD.	• Describe digital drafting principles and standards. • Explain orthographic	White Board, Marker, charts, projector, textbooks,	• Produce simple orthographic drawings using CAD software. • Prepare dimensioned	• Guide students to: Produce simple orthographic drawings using CAD software.	Computer laboratory, CAD software, printer,

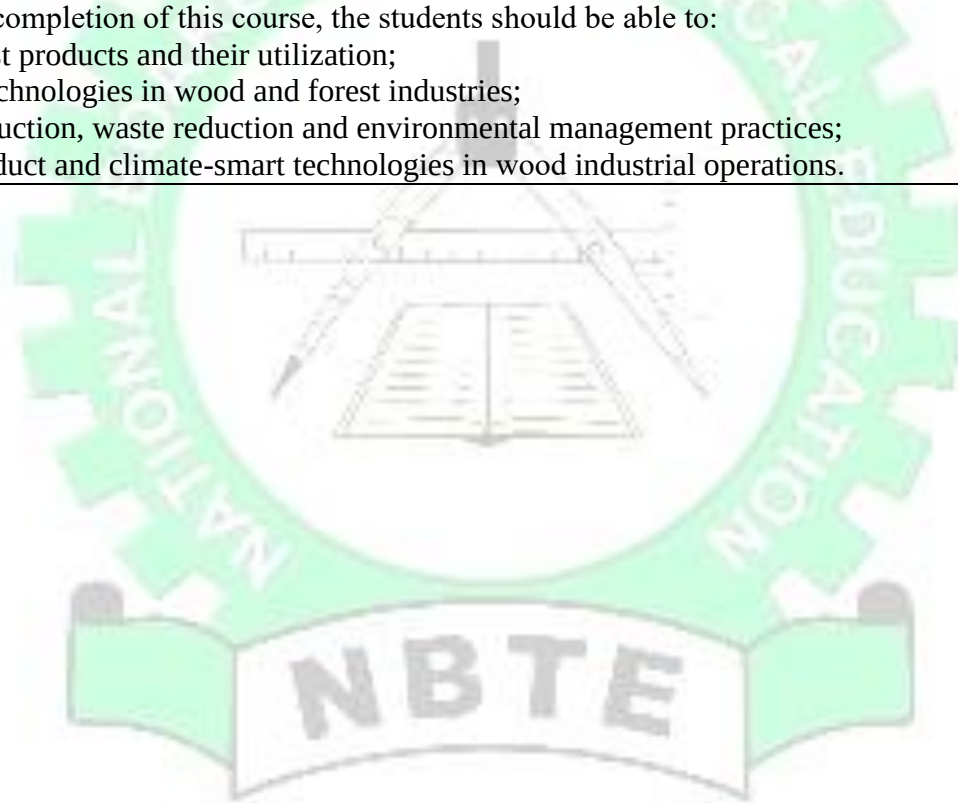
	2.3 Explain scaling and annotation procedures. 2.4 Describe work drawing preparation for wood products.	projection and dimensioning in CAD. • Discuss scaling and annotation procedures. • Explain working drawing preparation for wood products.	etc.	work drawings of simple wood products. • Apply scaling and annotation tools correctly. • Export completed digital drawings.	• Prepare dimensioned work drawings of simple wood products. • Apply scaling and annotation tools correctly. • Export completed digital drawings.	sample templates, practical manual .
General Objective 3.0: Comprehend CAD tools in furniture and wood product designs						
7–9	3.1 Explain CAD application in furniture design. 3.2 Describe design modification and editing procedures. 3.3 Explain introduction to 2D and basic 3D wood product modelling. 3.4 Describe product visualization techniques.	• Explain CAD application in furniture design. • Discuss design modification and editing procedures. • Explain introduction to 2D and basic 3D wood product modelling. • Discuss product visualization techniques.	White Board, Marker, charts, projector, textbooks, etc.	• Design simple furniture products such as table, chair, cabinet or shelf using CAD software. • Modify existing furniture drawings. • Produce simple 2D and introductory 3D wood product models. • Develop furniture design portfolio.	Guide student to; • Design simple furniture products such as table, chair, cabinet or shelf using CAD software. • Modify existing furniture drawings. • Produce simple 2D and introductory 3D wood product models. • Develop furniture design portfolio.	Computer laboratory, CAD software, furniture templates, practical manual.
General Objective 4.0: Apply CAD for production planning and workshop documentation						

10-12	4.1 Explain CAD application in cutting plans and material estimation. 4.2 Explain digital documentation for workshop production. 4.3 Describe preparation of workshop production drawings. 4.4 Explain digital storage and retrieval of production drawings.	• Describe CAD application in cutting plans and material estimation. • Discuss digital documentation for workshop production. • Explain preparation of workshop production drawings. • Discuss digital storage and retrieval of production drawings.	White Board, Marker, charts, projector, textbooks, etc.	• Prepare cutting layout for selected furniture product. • Produce workshop production drawing with dimensions. • Prepare material estimate using CAD drawing. • Organize digital project files for workshop use.	Guide student to: • Prepare cutting layout for selected furniture product. • Produce workshop production drawing with dimensions. • Prepare material estimate using CAD drawing. Organize digital project files for workshop use.	Computer laboratory, CAD software, printer, workshop templates, practical manual .
General Objective 5.0: Apply CAD technologies in industrial wood product development.						
13–15	5.1 Explain industrial application of CAD in wood industries. 5.2 Describe digital workflow in furniture production. 5.3 Explain emerging CAD technologies in wood product industries. 5.4 Describe quality and accuracy considerations in digital production systems.	• Describe industrial application of CAD in wood industries. • Discuss digital workflow in furniture production. • Describe emerging CAD technologies in wood product industries. • Explain quality and accuracy considerations in digital production systems.	White Board, Marker, charts, projector, textbooks, etc.			
COURSE ASSESSMENT: Course Work: 10% Test/Assignments: 10%						

Practical:	40%
Examination:	40%
Total:	100%



PROGRAMME: HIGHER NATIONAL DIPLOMA WOOD AND PAPER TECHNOLOGY (WOOD PRODUCTS PROCESSING TECHNOLOGY OPTION)		
COURSE TITLE: SUSTAINABLE FOREST PRODUCTS AND CLIMATE-SMART TECHNOLOGIES	COURSE CODE: WPP 416	CONTACT HOURS: 2HOURS/WEEK
	CREDIT UNIT: 2	THEORETICAL: 2HOURS/WEEK
YEAR: II SEMESTER: I	PRE-REQUISITE:	PRACTICAL: 0
GOAL: This course is designed to equip students with knowledge and skills in sustainable forest products, climate-smart technologies and environmentally responsible practices.		
GENERAL OBJECTIVES: On completion of this course, the students should be able to: 1.0 Understand sustainable forest products and their utilization; 2.0 Understand climate-smart technologies in wood and forest industries; 3.0 Understand sustainable production, waste reduction and environmental management practices; 4.0 Know sustainable forest product and climate-smart technologies in wood industrial operations.		



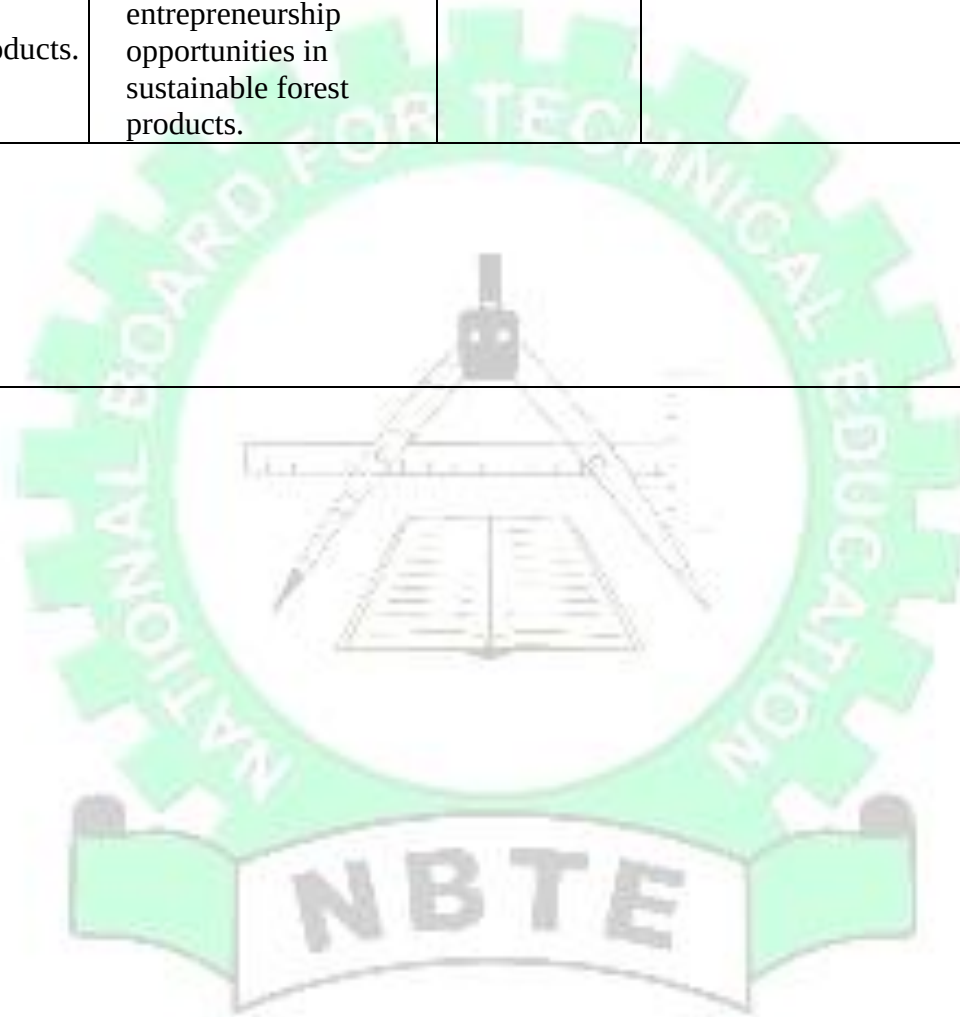
PROGRAMME: HIGHER NATIONAL DIPLOMA WOOD AND PAPER TECHNOLOGY (WOOD PRODUCTS PROCESSING TECHNOLOGY OPTION)						
COURSE TITLE: SUSTAINABLE FOREST PRODUCTS AND CLIMATE-SMART TECHNOLOGIES			COURSE CODE: WPP 416		CONTACT HOURS: 2HOURS/WEEK	
			CREDIT UNIT: 2		THEORETICAL: 2HOURS/WEEK	
YEAR: II SEMESTER: I			PRE-REQUISITE:		PRACTICAL: 0	
COURSE SPECIFICATION: THEORETICAL AND PRACTICAL						
GOAL: This course is designed to equip students with knowledge and practical competencies in sustainable forest products, climate-smart technologies and environmentally responsible practices.						
GENERAL OBJECTIVE 1.0: Understand sustainable forest products and their utilization						
THEORETICAL CONTENT				PRACTICAL CONTENT		
Week	Specific Learning Outcome	Teacher’s Activities	Resources	Specific Learning Outcome	Teacher’s Activities	Resources
1–3	1.1 Explain sustainable forest products and their importance. 1.2 Outline timber and non-timber forest products (NTFPs). 1.3 Describe sustainable utilization of forest products. 1.4 Explain economic and environmental importance of sustainable forest products.	• Describe sustainable forest products and their importance. • Discuss timber and non-timber forest products (NTFPs). • Explain sustainable utilization of forest products. • Discuss economic and environmental importance of sustainable forest products.	White Board, Marker, charts, projector, textbooks, etc.			
General Objective 2.0: Understand climate-smart technologies in wood and forest industries						
4–7	2.1 Explain climate-smart technologies in forest and	• Discuss climate-smart technologies in forest				

	wood industries. 2.2 Describe efficient timber processing and energy-saving technologies. 2.3 Explain renewable energy systems in wood industries. 2.4 Describe digital and smart technologies supporting sustainability.	and wood industries. • Explain efficient timber processing and energy-saving technologies. • Describe renewable energy systems in wood industries. • Explain digital and smart technologies supporting sustainability.				
General Objective 3.0: Understand sustainable production, waste reduction and environmental management practices						
8–11	3.1 Explain sustainable production principles in wood industries. 3.2 Explain waste minimization and resource efficiency practices 3.3 Describe environmental management systems in wood industries. 3.4 Describe carbon reduction and green production concepts.	• Describe sustainable production principles in wood industries. • Explain waste minimization and resource efficiency practices • Explain environmental management systems in wood industries. • Discuss carbon reduction and green production concepts.	White Board, Marker, charts, projector, textbooks, etc.			
General Objective 4.0: Know sustainable forest product and climate-smart technologies in industrial operations						
12–15	4.1 Explain industrial sustainability practices in wood industries. 4.2 Describe climate-smart technologies for production efficiency. 4.3 Explain emerging green	• Describe industrial sustainability practices in wood industries. • Discuss climate-smart technologies for production efficiency. • Explain emerging	White Board, Marker, charts, projector, textbooks, etc.			

	technologies in wood industries. 4.4 Describe entrepreneurship opportunities in sustainable forest products.	green technologies in wood industries. • Discuss entrepreneurship opportunities in sustainable forest products.				
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COURSE ASSESSMENT:

Course Work: 10%
 Test/Assignments: 10%
 Practical: 40%
 Examination: 40%
 Total: 100%





WOOD ENTERPRISE MANAGEMENT AND MARKETING

PROGRAMME: HIGHER NATIONAL DIPLOMA WOOD AND PAPER TECHNOLOGY (WOOD PRODUCT PROCESSING TECHNOLOGY OPTION)		
COURSE TITLE: WOOD ENTERPRISE MANAGEMENT AND MARKETING	COURSE CODE: WPP 421	CONTACT HOURS: 4HOURS/WEEK
	CREDIT UNIT: 4	THEORETICAL: 1HOUR/WEEK
YEAR: HND II SEMESTER: II	PRE-REQUISITE:	PRACTICAL: 3HOURS/WEEK
GOAL: This course is designed to equip students with knowledge and skills in wood enterprise management and marketing.		
GENERAL OBJECTIVES: On completion of this course, the students should be able to: 1.0 Understand wood enterprise management principles; 2.0 Know costing, pricing and inventory management techniques in wood enterprises; 3.0 Comprehend marketing and customer relationship techniques for wood products; 4.0 Apply entrepreneurship and business planning skills in wood enterprises; 5.0 Apply enterprise management and marketing practices in wood and paper industries.		

PROGRAMME: HIGHER NATIONAL DIPLOMA WOOD AND PAPER TECHNOLOGY (WOOD PRODUCT PROCESSING TECHNOLOGY OPTION)						
COURSE TITLE: WOOD ENTERPRISE MANAGEMENT AND MARKETING			COURSE CODE: WPP 421		CONTACT HOURS: 4HOURS/WEEK	
			CREDIT UNIT: 4		THEORETICAL: 1HOUR/WEEK	
YEAR: HND II SEMESTER: II			PRE-REQUISITE:		PRACTICAL: 3HOURS/WEEK	
COURSE SPECIFICATION: THEORETICAL AND PRACTICAL						
GOAL: This course is designed to equip students with knowledge and skills in wood enterprise management and marketing.						
GENERAL OBJECTIVE 1.0: Understand wood enterprise management principles;						
THEORETICAL CONTENT				PRACTICAL CONTENT		
Week	Specific Learning Outcome	Teacher’s Activities	Resources	Specific Learning Outcome	Teacher’s Activities	Resources
1–3	1.1 Explain concepts and importance of enterprise management in wood industries. 1.2 Explain types of wood enterprises and business opportunities. 1.3 Explain functions of enterprise management in wood and paper industries. 1.4 Explain factors affecting enterprise success and sustainability.	• Discuss concepts and importance of enterprise management in wood industries. • Describe types of wood enterprises and business opportunities. • Describe functions of enterprise management in wood and paper industries. • Discuss factors affecting enterprise success and sustainability.	Charts, Industrial case studies, Whiteboard, Marker, Projector, Textbooks, etc.	• Identify different wood enterprise opportunities in local environment. • Conduct simple market survey on wood products.	Guide student to: • Identify different wood enterprise opportunities in local environment. • Conduct simple market survey on wood products.	Market survey forms, Internet access (where available), Practical manual.
General Objective 2.0: Know costing, pricing and inventory management techniques in wood enterprises;						
4–6	2.1 Explain costing principles for wood products. 2.2 Explain pricing methods and profit	• Discuss costing principles for wood products. • Describe pricing methods and profit determination. • Describe inventory and	Charts, Industrial case studies, Whiteboard, Marker,	• Prepare costing estimate for selected wood product. • Determine selling	Guide students to: • Prepare costing estimate for selected wood product.	Calculator, Costing sheets, Inventory forms, computer, Practical manual.

	determination. 2.3 Explain inventory and stock management systems. 2.4 Explain record keeping procedures in wood enterprises.	stock management systems. Discuss record keeping procedures in wood enterprises.	Projector, Textbooks, etc.	price and profit margin. - Prepare inventory record for workshop materials and products. - Develop simple sales and stock record template.	- Determine selling price and profit margin. - Prepare inventory record for workshop materials and products. - Develop simple sales and stock record template.	
General Objective 3.0: Comprehend marketing and customer relationship techniques for wood products.						
7-9	3.1 Explain marketing principles for wood products. 3.2 Describe branding and product promotion techniques. 3.3 Explain customer service and relationship management. 3.4 Discuss digital marketing opportunities in wood enterprises.	- Discuss marketing principles for wood products. - Explain branding and product promotion techniques. - Describe customer service and relationship management. - Explain digital marketing opportunities in wood enterprises	Charts, Industrial case studies, Whiteboard, Marker, Projector, Textbooks, etc.	- Design simple product branding label for wood product. - Prepare marketing strategy for selected wood enterprise. - Conduct customer interaction simulation exercise. - Prepare digital product promotion concept.	Guide student to: - Design simple product branding label for wood product. - Prepare marketing strategy for selected wood enterprise. - Conduct customer interaction simulation exercise. - Prepare digital product	Product samples, Internet access, Design materials, Practical manual.

					promotion concept	
General Objective 4.0: Apply entrepreneurship and business planning skills in wood enterprises.						
10–12	4.1 Explain entrepreneurship principles in wood industries. 4.2 Explain procedures for starting and managing wood enterprise. 4.3 Describe business planning and risk management. 4.4 Explain financing opportunities for wood enterprises.	• Discuss entrepreneurship principles in wood industries. • Describe procedures for starting and managing wood enterprise. • Explain business planning and risk management. • Discuss financing opportunities for wood enterprises.	Charts, Industrial case studies, Whiteboard, Marker, Projector, Textbooks, etc.	• Prepare simple business plan for selected wood enterprise. • Conduct risk assessment for proposed business. • Prepare funding requirement estimate. • Present business proposal.	Guide student to: • Prepare simple business plan for selected wood enterprise. • Conduct risk assessment for proposed business. • Prepare funding requirement estimate. • Present business proposal.	Business plan templates, Notepads, computer, Practical manual.
General Objective 5.0: Apply enterprise management and marketing practices in wood and paper industries.						
13–15	5.1 Explain enterprise management practices in wood industries. 5.2 Discuss production and sales supervision procedures. 5.3 Explain emerging business opportunities in wood and paper industries. 5.4 Discuss sustainability	• Discuss enterprise management practices in wood industries. • Explain production and sales supervision procedures. • Discuss emerging business opportunities in wood and paper industries. • Explain sustainability and	Charts, Industrial case studies, Whiteboard, Marker, Projector, Textbooks, etc.	• Visit furniture workshop, timber market or wood enterprise and assess business operations. • Evaluate inventory, pricing and marketing systems.	Guide student to: • Visit furniture workshop, timber market or wood enterprise and assess business operations. • Evaluate inventory, pricing and	Notepads, Practical manual.

	and business growth strategies.	business growth strategies.			marketing systems.	
COURSE ASSESSMENT: Course Work: 10% Test/Assignments: 10% Practical: 40% Examination: 40% Total: 100%						



FURNITURE DESIGN AND INTERIOR WOOD PRODUCTS

PROGRAMME: HIGHER NATIONAL DIPLOMA WOOD AND PAPER TECHNOLOGY (WOOD PRODUCT PROCESSING TECHNOLOGY OPTION)		
COURSE TITLE: FURNITURE DESIGN AND INTERIOR WOOD PRODUCTS	COURSE CODE: WPP 422	CONTACT HOURS: 4HOURS/WEEK
	CREDIT UNIT: 4	THEORETICAL: 1HOUR/WEEK
YEAR: II SEMESTER: II	PRE-REQUISITE:	PRACTICAL: 3HOURS/WEEK
GOAL: This course is designed to equip students with knowledge and skills in furniture design, interior wood products furniture production, finishing and quality assessment for industrial and commercial applications.		
GENERAL OBJECTIVES: On completion of this course, the students should be able to: 1.0 Understand principles of furniture design and interior wood products; 2.0 Understand furniture materials, fittings and construction methods; 3.0 Apply furniture production techniques and workshop operations; 4.0 Apply furniture finishing and quality assessment techniques; 5.0 Understand furniture design and interior wood product technologies in industrial operations.		

PROGRAMME: HIGHER NATIONAL DIPLOMA WOOD AND PAPER TECHNOLOGY (WOOD PRODUCT PROCESSING TECHNOLOGY OPTION)						
COURSE TITLE: FURNITURE DESIGN AND INTERIOR WOOD PRODUCTS				COURSE CODE: WPP 422		CONTACT HOURS: 4HOURS/WEEK
				CREDIT UNIT: 4		THEORETICAL: 1HOUR/WEEK
YEAR: II SEMESTER: II				PRE-REQUISITE:		PRACTICAL: 3HOURS/WEEK
COURSE SPECIFICATION: THEORETICAL AND PRACTICAL						
GOAL: This course is designed to equip students with advanced knowledge and practical competencies in furniture design, interior wood products furniture production, finishing and quality assessment for industrial and commercial applications.						
GENERAL OBJECTIVE 1.0: Understand principles of furniture design and interior wood products;						
THEORETICAL CONTENT				PRACTICAL CONTENT		
Week	Specific Learning Outcome	Teacher’s Activities	Resources	Specific Learning Outcome	Teacher’s Activities	Resources
1-3	1.1 Explain principles of furniture design 1.2 Describe furniture styles and classifications 1.3 Explain ergonomics and aesthetics in furniture production 1.4 Explain interior wood products and their industrial applications. 1.5 Describe design considerations in furniture production.	• Discuss principles of furniture design. • Explain furniture styles and classifications. • Discuss ergonomics and aesthetics in furniture production. • Explain interior wood products and their industrial applications. • Explain design considerations in furniture production.	Furniture design charts, Furniture catalogues, Projector, Whiteboard, Markers, Textbooks, etc.	• Sketch simple furniture designs manually • Sketch simple furniture designs using digital tools. • Identify furniture styles and interior wood products. • Prepare furniture design portfolio.	Guide student to: • Sketch simple furniture designs manually • Sketch simple furniture designs using digital tools. • Identify furniture styles and interior wood products. • Prepare furniture design portfolio.	Drawing materials, Computer, Furniture catalogues practical manual.
General Objective 2.0: Understand furniture materials, fittings and construction methods;						
4-6	2.1 Explain materials used in furniture production. 2.2 Describe furniture	• Describe materials used in furniture production.	Furniture design charts, Furniture	• Identify furniture fittings and accessories.	Guide students to: • Identify furniture fittings and	Timber pieces, Workshop

	fittings and accessories. 2.3 Describe wood joints and construction methods. 2.4 Explain selection criteria for furniture materials.	• Explain furniture fittings and accessories. • Explain wood joints and construction methods. • Describe selection criteria for furniture materials	catalogues, Projector, Whiteboard, Markers, Textbooks, etc.	• Prepare selected wood joints: mortise and tenon, dovetail, lap and butt joints. • Compare materials used in furniture production.	accessories. • Prepare selected wood joints: mortise and tenon, dovetail, lap and butt joints. • Compare materials used in furniture production.	tools, Fittings, Glue, PPE, Practical manual etc.
General Objective 3.0: Apply furniture production techniques and workshop operations.						
7-11	3.1 Explain stages in furniture production. 3.2 Explain measurement, marking and cutting procedures. 3.3 Describe furniture assembly techniques. 3.4 Explain workshop machine operations in furniture production. 3.5 Describe safety precautions in furniture workshop operations.	• Describe stages in furniture production. • Describe measurement, marking and cutting procedures. • Explain furniture assembly techniques. • Describe workshop machine operations in furniture production. • Explain safety precautions in furniture workshop operations.	Furniture design charts, Furniture catalogues, Projector, Whiteboard, Markers, Textbooks, etc.	• Carry out measurement, marking and cutting of timber for selected furniture products. • Fabricate simple furniture item (e.g., stool, table, cabinet or shelf). • Assemble furniture components using appropriate joints and fittings. • Demonstrate safe handling of workshop tools and machines. • Prepare production record sheet and	Guide students to: • Carry out measurement, marking and cutting of timber for selected furniture products. • Fabricate simple furniture item (e.g., stool, table, cabinet or shelf). • Assemble furniture components using appropriate joints and	Timber, workshop machines, Measuring tape, Glue, Fittings, PPE, Practical manual.

				costing estimate.	fittings. • Demonstrate safe handling of workshop tools and machines. • Prepare production record sheet and costing estimate.	
General Objective 4.0: Apply furniture finishing and quality assessment techniques						
12-13	4.1 Explain furniture finishing methods. 4.2 Describe sanding, polishing, painting and varnishing techniques. 4.3 Explain furniture defects and quality assessment procedures. 4.4 Explain maintenance and care of furniture products.	• Describe furniture finishing methods. • Explain sanding, polishing, painting and varnishing techniques. • Discuss furniture defects and quality assessment procedures. • Describe maintenance and care of furniture products.	Furniture design charts, Furniture catalogues, Projector, Whiteboard, Markers, Textbooks, etc.	• Finish fabricated furniture product. • Apply varnish, paint or polish to selected furniture item. • Identify finishing defects and carry out corrections. • Assess quality of finished furniture product.	Guide students to: • Sand and finish fabricated furniture product. • Apply varnish, paint or polish to selected furniture item. • Identify finishing defects and carry out corrections. • Assess quality of finished furniture product.	Sandpaper, Varnish, Paint, Brushes, PPE, Workshop tools, Practical manual.
General Objective 5.0: Understand furniture design and interior wood product technologies in industrial operations.						
14-15	5.1 Explain industrial furniture production	• Describe industrial furniture production	Furniture design charts,	• Visit furniture workshop/showroom	Guide student to: • Visit furniture	Notepads, Practical

	systems. 5.2 Describe costing and pricing of furniture products. 5.3 Discuss quality assurance systems in furniture industries. 5.4 Explain emerging trends in furniture and interior wood product technologies	systems. • Explain costing and pricing of furniture products. • Explain quality assurance systems in furniture industries. • Discuss emerging trends in furniture and interior wood product technologies	Furniture catalogues, Projector, Whiteboard, Markers, Textbooks, etc.	and assess production practices. • Compare furniture products based on design, quality and finishing. • Prepare costing estimate for selected furniture product.	workshop/show room and assess production practices. • Compare furniture products based on design, quality and finishing. • Prepare costing estimate for selected furniture product.	manual.
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COURSE ASSESSMENT:

Course Work:	10%
Test/Assignments:	10%
Practical:	40%
Examination:	40%
Total:	100%

WOOD INNOVATION, PRODUCT DEVELOPMENT AND GREEN MANUFACTURING

PROGRAMME: HIGHER NATIONAL DIPLOMA WOOD AND PAPER TECHNOLOGY (WOOD PRODUCT PROCESSING TECHNOLOGY OPTION)		
COURSE TITLE: WOOD INNOVATION, PRODUCT DEVELOPMENT AND GREEN MANUFACTURING	COURSE CODE: WPP 423	CONTACT HOURS: 4HOURS/WEEK
	CREDIT UNIT: 4	THEORETICAL: 1HOUR/WEEK
YEAR: II SEMESTER: II	PRE-REQUISITE:	PRACTICAL: 3HOURS/WEEK
GOAL: This course is designed to equip students with knowledge and skills in wood product innovation, product development, green manufacturing and sustainable production systems.		
GENERAL OBJECTIVES: On completion of this course, the students should be able to: 1.0 Understand concepts and processes of wood innovation and product development; 2.0 Know product design, prototyping and product improvement techniques; 3.0 Understand green manufacturing and sustainable production systems; 4.0 Apply product testing, branding and commercialization techniques; 5.0 Apply wood innovation and green manufacturing practices in industrial operations.		

PROGRAMME: HIGHER NATIONAL DIPLOMA WOOD AND PAPER TECHNOLOGY (WOOD PRODUCT PROCESSING TECHNOLOGY OPTION)						
COURSE TITLE: WOOD INNOVATION, PRODUCT DEVELOPMENT AND GREEN MANUFACTURING			COURSE CODE: WPP 423		CONTACT HOURS: 4HOURS/WEEK	
			CREDIT UNIT: 4		THEORETICAL: 1HOUR/WEEK	
YEAR: II SEMESTER: II			PRE-REQUISITE:		PRACTICAL: 3HOURS/WEEK	
COURSE SPECIFICATION: THEORETICAL AND PRACTICAL						
GOAL: This course is designed to equip students with knowledge and skills in wood product innovation, product development, green manufacturing and sustainable production systems.						
GENERAL OBJECTIVE 1.0: Understand concepts and processes of wood innovation and product development;						
THEORETICAL CONTENT				PRACTICAL CONTENT		
Week	Specific Learning Outcome	Teacher’s Activities	Resources	Specific Learning Outcome	Teacher’s Activities	Resources
1–3	1.1 Explain concepts and importance of innovation in wood industries. 1.2 Explain stages in wood product development. 1.3 Describe sources of product ideas and innovation opportunities. 1.4 Explain challenges affecting product development in wood industries.	• Discuss the concepts and importance of innovation in wood industries. • Describe stages in wood product development. • Explain sources of product ideas and innovation opportunities. • Discuss challenges affecting product development in wood industries.	Charts, Case studies, Video clips, Projector, Whiteboard, Textbooks, etc.	• Identify innovative wood products in local and international markets. • Generate ideas for new wood products. • Prepare product idea portfolio.	Guide students to: • Identify innovative wood products in local and international markets. • Generate ideas for new wood products. • Prepare product idea portfolio.	Product catalogues, Internet access, Notepads, Practical manual.
General Objective 2.0: Know product design, prototyping and product improvement techniques.						

4–7	2.1 Explain product design and prototyping principles. 2.2 Describe redesign and improvement of existing wood products. 2.3 Explain selection of suitable materials for product development. 2.4 Outline factors affecting product functionality and durability.	• Describe product design and prototyping principles. • Explain redesign and improvement of existing wood products. • Discuss selection of suitable materials for product development. • Discuss factors affecting product functionality and durability.	Charts, Case studies, Video clips, Projector, Whiteboard, Textbooks, etc.	• Design prototype for selected wood product. • Modify existing furniture or wood product. • Select suitable materials for product fabrication. • Prepare prototype documentation and costing estimate.	Guide students to: • Design prototype for selected wood product. • Modify existing furniture or wood product. • Select suitable materials for product fabrication. • Prepare prototype documentation and costing estimate.	Timber materials, Workshop tools, CAD software, Practical manual.
General Objective 3.0: Understand green manufacturing and sustainable production systems						
8–10	3.1 Explain principles of green manufacturing. 3.2 Discuss sustainable material utilization and waste reduction strategies. 3.3 Explain energy-efficient production systems. 3.4 Describe environmental considerations in wood product manufacturing.	• Discuss principles of green manufacturing. • Explain sustainable material utilization and waste reduction strategies. • Describe energy-efficient production systems. • Discuss environmental considerations in wood product manufacturing.	Charts, Case studies, Video clips, Projector, Whiteboard, Textbooks, etc.	• Conduct waste assessment for selected production activity. • Evaluate material efficiency during product fabrication. • Develop simple green manufacturing checklist. • Prepare waste reduction recommendations.	Guide students to: • Conduct waste assessment for selected production activity. • Evaluate material efficiency during product fabrication. • Develop simple green manufacturing checklist. • Prepare waste reduction recommendations.	Checklist forms, Measuring tools, Practical manual.
General Objective 4.0: Apply product testing, branding and commercialization techniques.						

11–13	4.1 Explain product performance and quality assessment. 4.2 Discuss branding and packaging concepts for wood products. 4.3 Explain product commercialization and market entry strategies. 4.4 Explain customer acceptance and feedback systems.	• Discuss product performance and quality assessment. • Explain branding and packaging concepts for wood products. • Discuss product commercialization and market entry strategies. • Describe customer acceptance and feedback systems.	Charts, Case studies, Video clips, Projector, Whiteboard, Textbooks, etc.	4.1 Test performance of developed prototype. 4.2 Develop simple product branding concept. 4.3 Prepare commercialization plan for selected wood product. 4.4 Present prototype and business pitch.	Guide students to: • Test performance of developed prototype. • Develop simple product branding concept. • Prepare commercialization plan for selected wood product. • Present prototype and business pitch.	Prototype products, Branding materials, Presentation materials, practical manual.
General Objective 5.0: Apply wood innovation and green manufacturing practices in industrial operations						
14–15	5.1 Explain industrial innovation systems in wood industries. 5.2 Explain sustainable product development practices. 5.3 Outline emerging technologies in green manufacturing. 5.4 Outline entrepreneurship opportunities in innovative wood products.	• Describe industrial innovation systems in wood industries. • Discuss sustainable product development practices. • Explain emerging technologies in green manufacturing. • Explain entrepreneurship opportunities in innovative wood products.	Charts, Case studies, Video clips, Projector, Whiteboard, Textbooks, etc.			
COURSE ASSESSMENT: Course Work: 10%						

Test/Assignments:	10%
Practical:	40%
Examination:	40%
Total:	100%



BIOMASS, BIOENERGY AND RESIDUE UTILIZATION

PROGRAMME: HIGHER NATIONAL DIPLOMA WOOD AND PAPER TECHNOLOGY (WOOD PRODUCT PROCESSING TECHNOLOGY OPTION)		
COURSE TITLE: BIOMASS, BIOENERGY AND RESIDUE UTILIZATION	COURSE CODE: WPP 424	CONTACT HOURS: 4HOURS/WEEK
	CREDIT UNIT: 4	THEORETICAL: 1HOUR/WEEK
YEAR: II SEMESTER: II	PRE-REQUISITE:	PRACTICAL: 3HOURS/WEEK
GOAL: This course is designed to equip students with knowledge and skills in biomass utilization, bioenergy systems, wood residue conversion and waste-to-value technologies for sustainable industrial production and energy generation.		
GENERAL OBJECTIVES: On completion of this course, the students should be able to: 1.0 Understand biomass resources and bioenergy systems; 2.0 Know biomass conversion and residue utilization techniques; 3.0 Understand bioenergy production, performance and sustainability systems; 4.0 Apply waste-to-value and entrepreneurship techniques in biomass systems; 5.0 Apply biomass and residue utilization systems in industrial operations.		

PROGRAMME: HIGHER NATIONAL DIPLOMA WOOD AND PAPER TECHNOLOGY (WOOD PRODUCT PROCESSING TECHNOLOGY OPTION)						
COURSE TITLE: BIOMASS, BIOENERGY AND RESIDUE UTILIZATION			COURSE CODE: WPP 424		CONTACT HOURS: 4HOURS/WEEK	
			CREDIT UNIT: 4		THEORETICAL: 1HOUR/WEEK	
YEAR: II SEMESTER: II			PRE-REQUISITE:		PRACTICAL: 3HOURS/WEEK	
COURSE SPECIFICATION: THEORETICAL AND PRACTICAL						
GOAL: This course is designed to equip students with knowledge and skills in biomass utilization, bioenergy systems, wood residue conversion and waste-to-value technologies for sustainable industrial production and energy generation.						
GENERAL OBJECTIVE 1.0: Understand biomass resources and bioenergy systems						
THEORETICAL CONTENT				PRACTICAL CONTENT		
Week	Specific Learning Outcome	Teacher’s Activities	Resources	Specific Learning Outcome	Teacher’s Activities	Resources
1–3	1.1 Explain biomass and bioenergy concepts. 1.2 Explain biomass resources and wood residues for energy production. 1.3 Explain sources and characteristics of biomass materials. 1.4 Outline the importance of biomass in sustainable energy systems.	• Discuss biomass and bioenergy concepts. • Describe biomass resources and wood residues for energy production. • Describe sources and characteristics of biomass materials. • Explain importance of biomass in sustainable energy systems.	Biomass charts, Wood residue samples, Video clips, Projector, Textbooks, etc.	• Identify and classify biomass materials and wood residues. • Compare characteristics of selected biomass materials. • Prepare biomass inventory record sheet. • Assess suitability of biomass materials for energy production.	Guide students to: • Identify and classify biomass materials and wood residues. • Compare characteristics of selected biomass materials. • Prepare biomass inventory record sheet. • Assess suitability of biomass materials for energy production.	Biomass samples, Inventory sheets, Notepads, Practical manual.

General Objective 2.0 Know biomass conversion and residue utilization techniques						
4–7	2.1 Explain briquette, pellet and biofuel production systems. 2.2 Explain biomass conversion principles. 2.3 Describe factors affecting biomass performance and efficiency. 2.4 Describe industrial residue utilization systems.	- Describe briquette, pellet and biofuel production systems. - Discuss biomass conversion principles. - Explain factors affecting biomass performance and efficiency. - Explain industrial residue utilization systems.	Biomass charts, Wood residue samples, Video clips, Projector, Textbooks, etc.	- Produce briquettes and simple biomass fuel products using wood residues. - Compare briquette quality from selected materials. - Prepare simple pelletized biomass material (where facilities exist).	Guide students to: - Produce briquettes and simple biomass fuel products using wood residues. - Compare briquette quality from selected materials. - Prepare simple pelletized biomass material (where facilities exist).	Sawdust, Binder, Mould, Pelletizer PPE, Practical manual.
General Objective 3.0: Understand bioenergy production, performance and sustainability systems.						
8–10	3.1 Explain energy conversion systems for biomass. 3.2 Describe calorific value and combustion principles. 3.3 Explain sustainability considerations in biomass systems. 3.4 Describe environmental implications of biomass utilization.	- Describe energy conversion systems for biomass. - Explain calorific value and combustion principles. - Discuss sustainability considerations in biomass systems. - Explain environmental implications of biomass utilization.	Biomass charts, Wood residue samples, Video clips, Projector, Textbooks, etc.	- Conduct simple combustion assessment of biomass products under controlled conditions. - Compare burning efficiency of selected briquettes. - Assess energy performance of biomass products.	Guide students to: - Conduct simple combustion assessment of biomass products under controlled conditions. - Compare burning efficiency of selected briquettes. - Assess energy performance of biomass	Biomass samples, Weighing scale, Controlled test equipment, PPE, Practical manual.

					products.	
General Objective 4.0: Apply waste-to-value and entrepreneurship techniques in biomass systems;						
11–13	4.1 Explain waste-to-value concepts in biomass systems. 4.2 Outline entrepreneurship opportunities in biomass production. 4.3 Explain costing and marketing of biomass products. 4.4 Discuss safety requirements in biomass processing.	- Describe waste-to-value concepts in biomass systems. - Explain entrepreneurship opportunities in biomass production. - Describe costing and marketing of biomass products. - Explain safety requirements in biomass processing.	Biomass charts, Wood residue samples, Video clips, Projector, Textbooks, etc.	- Prepare costing estimate for briquette or biomass fuel production. - Develop simple biomass business idea. - Prepare biomass product branding concept. - Present waste-to-value proposal.	Guide students to: - Prepare costing estimate for briquette or biomass fuel production. - Develop simple biomass business idea. - Prepare biomass product branding concept. - Present waste-to-value proposal.	Costing templates, Notepads, Computer, Practical manual.
General Objective 5.0: Apply biomass and residue utilization systems in industrial operations						
14–15	5.1 Explain industrial biomass and residue utilization systems. 5.2 Describe industrial energy efficiency practices. 5.3 Outline emerging technologies in biomass and bioenergy systems. 5.4 Explain sustainability practices in biomass enterprises.	- Describe industrial biomass and residue utilization systems. - Explain industrial energy efficiency practices. - Explain emerging technologies in biomass and bioenergy systems. - Discuss sustainability practices in biomass enterprises.	Biomass charts, Wood residue samples, Video clips, Projector, Textbooks, etc.	- Visit biomass facility, sawmill or wood processing enterprise and assess residue utilization systems. - Evaluate biomass production and waste-to-value practices observed.	Guide students to: - Visit biomass facility, sawmill or wood processing enterprise and assess residue utilization systems. - Evaluate biomass production and waste-to-value	Notepads, Practical manual.

					practices observed.	
COURSE ASSESSMENT: Course Work: 10% Test/Assignments: 10% Practical: 40% Examination: 40% Total: 100%						



LIST OF MINIMUM RESOURCES/PHYSICAL FACILITIES**A. DRAWING ROOM / SURVEY EQUIPMENT**

S/N	DESCRIPTION OF ITEMS	QUANTITY REQUIRED
1.	Drawing Boards / Stools	30
2.	Drafting set	5
3.	T-Square	10
4.	Set square	10
5.	Protractors	10
6.	Lettering set	10
7.	Stereoscope	4
8.	Prismatic compass	3
9.	Ranging Poles	10
10.	Gunter's Chain	2
11.	Metric Tape	2
12.	Planimeters	1
13.	Theodolite and Staff	1
14.	Scale Rulers	15
15.	Set of Arrows	30
16.	Levels	10
17.	Pantograph	10

B. AUDIO VISUAL ROOM / ICT & TEACHING FACILITIES

SN	DESCRIPTION OF ITEMS	QUANTITY REQUIRED
1.	Video Recorder	2
2.	Slide Projector	2
3.	Overhead Projector	2
4.	Film Projector	2
5.	Magnetic Board	2
6.	Public Address System	1
7.	Smart TV	2

8.	Cameras	3
9.	Enlarger	1
10.	Photo dryer	1
11.	Photo cutter	1
12.	Multimedia projector	1
13.	Smart board	1
14.	Desktop computers	Several
15.	Internet facilities	1 setup
16.	CAD/CAM software	1 license
17.	Furniture design software	1 license
18.	Printer and scanner	1 each
19.	Technical drawing tables	5
20.	Library resources	1 set
21.	Instructional charts and models	Various
22.	Computer system with wood identification software	1



C. PEST CONTROL EQUIPMENT

SN	DESCRIPTION OF ITEMS	QUANTITY REQUIRED
1.	Knapsack Pressure Sprayer	2
2.	Motorized mist sprayer	1
3.	Handy sprayer	5
4.	Hand sprayer with container	5
5.	Flood jet nozzles	5
6.	Boom sprayer	1

D. WOOD ANATOMY & IDENTIFICATION LABORATORY

SN	DESCRIPTION OF ITEMS	QUANTITY REQUIRED
1.	Compound light microscope	2+
2.	Stereo microscope	2+
3.	Microtome machine	1
4.	Hand lens	10+
5.	Wood specimen cabinet	1
6.	Digital moisture meter	2
7.	Vernier caliper	5+
8.	Measuring tape	5+
9.	Digital weighing balance	2+
10.	Drying oven	1
11.	Sample preparation knives	Set
12.	Slides and cover slips	Several
13.	Laboratory glassware	Set
14.	Hot plate	2
15.	pH meter	2
16.	Desiccator	1
17.	Timber sample racks	Several

E. WOOD SEASONING & PRESERVATION LABORATORY

SN	DESCRIPTION OF ITEMS	QUANTITY REQUIRED
1.	Laboratory kiln dryer	1
2.	Moisture meters	2
3.	Hygrometer	2
4.	Thermometer	3+
5.	Vacuum-pressure treatment cylinder	1
6.	Preservation chemical tanks	2
7.	Spray equipment	2
8.	Drying racks	Several
9.	Timber stacking stickers	Set
10.	Water absorption test apparatus	1
11.	Treatment brushes	5
12.	Wood defect inspection tools	Set
13.	Chemical storage cabinet	1
14.	Oven	1

F. TIMBER MECHANICS & STRENGTH TESTING LABORATORY

SN	DESCRIPTION OF ITEMS	QUANTITY REQUIRED
1.	Universal testing machine (UTM)	1
2.	Compression testing machine	1
3.	Impact testing machine	1
4.	Hardness testing machine	1
5.	Bending test apparatus	1
6.	Torsion testing machine	1
7.	Deflection measuring gauges	Set
8.	Load cells	Set
9.	Dial gauges	5
10.	Micrometer screw gauge	5
11.	Timber sample cutting machine	1
12.	Conditioning chamber	1

G. WOODWORK WORKSHOP

SN	DESCRIPTION OF ITEMS	QUANTITY REQUIRED
1.	Circular saw machine	1
2.	Band saw machine	2
3.	Surface planer	2
4.	Thickness planer	2
5.	Spindle moulder	1
6.	Wood lathe	1
7.	Mortising machine	1
8.	Tenoning machine	1
9.	Drilling machine	2
10.	CNC router	1
11.	Edge banding machine	1
12.	Belt sanding machine	1
13.	Cross-cut saw	1
14.	Rip saw	1
15.	Panel saw	1
16.	Hydraulic press	1
17.	Veneer peeling machine	1
18.	Wood crusher/chipper	1
19.	Working benches with vice	10
20.	Hammers	Several
21.	Mallets	2 sets
22.	Hand saws	Several
23.	Chisels	Set
24.	Screwdrivers	Set
25.	Spanners	Set
26.	Hand planes	Set
27.	Try square	Several
28.	Marking gauge	Several
29.	Clamps	Several
30.	Wood files	Set

31.	Rasps	Set
32.	Spirit level	Several
33.	Pliers	Several
34.	Nail punches	Set
35.	Sharpening stones	Several
36.	Portable circular saw	1
37.	Electric drill	2
38.	Orbital sander	1
39.	Jig saw	1
40.	Angle grinder	1
41.	Portable router	1
42.	Nail gun	1
43.	Heat gun	1
44.	Fire extinguishers	Several
45.	First aid box / kit	2
46.	Eye wash station	1
47.	Fire alarm system	1
48.	PPE kits (full)	Several
49.	Safety boots	30 pairs
50.	Nose masks	Several
51.	Hand gloves	15 pairs +
52.	Ear protectors	Several
53.	Safety goggles	Several
54.	Workshop ventilation system	1
55.	Dust extraction system	1
56.	Emergency exits	As required
57.	Safety sign boards	Several
58.	Safety helmet	15
59.	Rain boots	30 pairs
60.	Rain coats	30 pairs

H. PULP AND PAPER TECHNOLOGY LABORATORY

SN	DESCRIPTION OF ITEMS	QUANTITY REQUIRED
1.	Laboratory pulper	1
2.	Beater/refiner	1
3.	Sheet forming machine	1
4.	Paper press machine	1
5.	Drying plates	Set
6.	Fiber disintegrator	1
7.	Water bath	1
8.	Laboratory blender	1
9.	Brightness tester	1
10.	Paper thickness gauge	1
11.	Tensile strength tester	1
12.	Bursting strength tester	1
13.	Tear resistance tester	1
14.	Cobb sizing tester	1
15.	GSM balance	1
16.	Chemical storage containers	Several
17.	Spray booth	1
18.	Air compressor	1
19.	Spray guns	2
20.	Paint brushes	Set
21.	Sanding machines	2
22.	Polishing machine	1
23.	Drying racks	Several
24.	Finishing tables	2
25.	Mixing containers	Set
26.	Measuring cups	Set
27.	Paint viscosity cup	1
28.	Wood staining equipment	Set
29.	Fire extinguishers	Several
30.	First aid box / kit	2

31.	Eye wash station	1
32.	Fire alarm system	1
33.	PPE kits (full)	Several
34.	Safety boots	30 pairs
35.	Nose masks	Several
36.	Hand gloves	15 pairs +
37.	Ear protectors	Several
38.	Safety goggles	Several
39.	Workshop ventilation system	1
40.	Dust extraction system	1
41.	Emergency exits	As required
42.	Safety sign boards	Several
43.	Safety helmet	15
44.	Rain boots	30 pairs
45.	Rain coats	30 pairs

I. BIOENERGY AND WOOD CHEMISTRY LABORATORY

SN	EQUIPMENT	QUANTITY REQUIRED
1.	Bomb calorimeter	1
2.	Muffle furnace	1
3.	Retort kiln	1
4.	Distillation apparatus	1
5.	Soxhlet extractor	1
6.	Analytical balance	1
7.	Fume hood	1
8.	Biomass briquetting machine	1
9.	Charcoal testing equipment	Set
10.	Chemical reagent shelves	Several

J. METAL WORKSHOP AND MAINTENANCE EQUIPMENT

SN	EQUIPMENT	QUANTITY REQUIRED
1.	Lathe	1
2.	Pipe benders	3
3.	Anvils	1
4.	Micrometers (inside, outside)	5
5.	Stock and dice set	5
6.	Drill sets	5
7.	Electrical hand drills	2
8.	Tool boxes	5
9.	Hydraulic jack (12 and 15 tons)	1 each
10.	Box of drill	4
11.	Battery charger	1
12.	Grease guns	1
13.	Pipe cutter	1
14.	Scribers	1
15.	Steel ruler	5
16.	Pipe screwing threading	2
17.	Arc welding equipment + working benches	8 tables
18.	Arc welder	30
19.	Electric grinder	2
20.	Welding gloves	15
21.	Welding helmet	15
22.	Wire brush	5
23.	Welding boots and screen	15
24.	Soldering equipment	4
25.	Blowtorch	4
26.	Tin snips	4
27.	Soldering flux	4
28.	Sheet metal sheer	4
29.	Mallet hammer	4
30.	Hack saw	4

31.	Oxygen and acetylene bottles	3
32.	Oxygen and acetylene regulators	2
33.	Cylinders wrenches	3
34.	Spark lighter	5
35.	Service pit	1
36.	Teaching models (tractor engines, ploughs, etc.)	Various
37.	Fire extinguishers	Several
38.	First aid box / kit	2
39.	Eye wash station	1
40.	Fire alarm system	1
41.	PPE kits (full)	Several
42.	Safety boots	30 pairs
43.	Nose masks	Several
44.	Hand gloves	15 pairs +
45.	Ear protectors	Several
46.	Safety goggles	Several
47.	Workshop ventilation system	1
48.	Dust extraction system	1
49.	Emergency exits	As required
50.	Safety sign boards	Several
51.	Safety helmet	15
52.	Rain boots	30 pairs
53.	Rain coats	30 pairs

K. OUTDOOR FACILITY

SN	EQUIPMENT	QUANTITY REQUIRED
1.	Wood graveyard (Adequately stocked)	1

L. LOGGING AND MENSURATION EQUIPMENT

SN	EQUIPMENT	QUANTITY REQUIRED
1.	Power saw	2

2.	Bow saw	4
3.	Axe	10
4.	Sledgehammer	1
5.	Wedge	2
6.	File (flat type)	3
7.	Round file	3
8.	Circular saw blades	5
9.	Grinding stone	4
10.	Bench vice	4
11.	Girthing tapes	5
12.	Abney level	1
13.	Improvised measuring poles	10
14.	Haga altimeter	5
15.	Improvised christens Hypsometer	5
16.	Back gauge	5
17.	Calipers	5
18.	Increment borers	5
19.	Relascope	4

LIST OF PARTICIPANTS

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