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WOODWORK

1. **PREAMBLE**

The course in Woodwork at the Senior High School level is to enable students gain knowledge in the art and craft of woodworking and provide with basic and necessary skills for technological growth. At this level, the knowledge to be acquired will act as an avenue for further growth during and after school.

It is intended to give candidates the opportunity to display detailed knowledge of, and skills in

- (1) technical drawing and designing;
- (2) practical work;
- (3) methods and principles of construction;
- (4) quality control, estimation and costing.

2. **AIMS**

Candidates are expected to demonstrate

- (1) creative ability, mental and practical skills in the use of hand and machine tools for construction of basic items in wood and related materials;
- (2) good basic knowledge of design and reading of working drawings;
- (3) ability to plan and follow a sequence of work operations which are necessary to lead to successful completion of projects;
- (4) awareness of problems relating to wood and the wood industry;
- (5) functional skills capable of providing a means of livelihood in woodworking.

3. **ASSESSMENT OBJECTIVES**

(1) Candidates should be able to demonstrate knowledge and understanding of:

- (a) terminologies used in woodwork;
- (b) materials used in woodwork;
- (c) care and maintenance of handtools and machines;
- (d) safety precautions at the workshop;
- (e) principles of designing and drawing;
- (f) methods and principles of construction.

(2) Candidates should be able to demonstrate the ability to:

- (a) follow a given design brief to produce working drawings;
- (b) interpret working drawings;

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- (c) use tools, equipment and materials to carry out practical operations in sequential order;
 - (d) prepare surfaces and apply appropriate finishes.
- (3) Candidates should be able to:
- (a) compare features of different items and make comments or judgment, contrast, justify, support or criticize a job;
 - (b) write appraisal report on artefacts.

4. **STRUCTURE AND SCHEME OF EXAMINATION**

There will be three papers, Papers 1, 2 and 3 all of which must be taken. Papers 1 and 2 will be a composite paper to be taken at one sitting.

PAPER 1: Will consist of forty multiple-choice objective questions all of which must be answered within 40 minutes for 40 marks.

PAPER 2: Will consist of theory and design paper of two sections, Sections A and B, to be taken within 2 hours, 20 minutes.

Section A will be short structured questions put into three parts, Parts I, II and III as follows:

- Part I will be for candidates in Ghana only.
- Part II will be for candidates in Nigeria, Sierra Leone and The Gambia.
- Part III will be for all candidates. It will comprise of two questions out of which all candidates will be required to answer one.

Section B will comprise design and drawing questions, all of which must be answered within 1 hour 40 minutes for 40 marks.

PAPER 3: Will be a practical test lasting 3 hours. Candidates will be required to make a test piece for which the appropriate drawings will be supplied. It will carry 100 marks.

5. **DETAILED SYLLABUS**

A. **PRACTICAL**

1. The practical activities would require the use of
 - (1) common hand tools;
 - (2) portable power tools and basic woodworking machines;
 - (3) different joints and shapes;
 - (4) nails, screws and other means of fastening.

2. Candidates will be required to work from dimensioned sketches, written descriptions or scaled drawings. They are expected to be able to construct the following joints:
- (a) widening joints – e.g. plain/simple butt, dowelled, tongue and grooved, rebated butt, loose tongue, slot screw.
 - (b) angle joints - for box-like construction, e.g. common and lapped dovetail, pin/comb/finger, dowel, housing, halving and plain mitre.
 - (c) Framing joints – e.g. Mortice and tenon, bridle, mitre, dowel and halving.
 - (d) Candidates will also be expected to be able to perform the following operations:
 - (i) shaping – e.g chamfering, rounding, tapering, beveling and splaying;
 - (ii) assembling and finishing – e.g testing for squareness, parallelism, use of diagonals, trial assembly, cramping, preparation of surfaces, application of finishes.

B. THEORY

TOPIC	NOTES
1. <u>WORKSHOP SAFETY</u>	
1.1 Personal Safety Uses of safety equipment; first aid box and its use. Safety to prevent injury to self and others in the workshop, wearing of protective clothing (e.g goggles, aprons/overalls, masks, boots, helmets, gloves, respirators).	Types of safety measures and
1.2 Safety relating to hand tools, machines and workshop environment. workshop environment, e.g. lighting, ventilation, exit doors.	Safety measures in relation to the use of hand tools, machines, electrical appliances; state of
1.3 Safety devices block, jigs, fences.	Knowledge of types of safety
1.4 First Aid burns, and electric shock.	(a) Knowledge of the contents of a First Aid box (i.e lint, scissors, bandages, plaster, methylated spirit, iodine, cotton wool, forceps). (b) Knowledge of the procedure for administration of first aid for cuts,
2. <u>TOOLS</u>	
2.1 Hand Tools	Identification, classification, sketching, sharpening, maintenance, storage, safety and use of the following:-

(a) Measuring and marking-out tools:
rules, calipers, gauges.

(b) Cutting and shaping tools: saws,
planes, chisels, spokeshaves.

(c) Abrading and scraping tools: files,
scrapers.

(d) Boring tools - braces, bits, drills,
gimlet, bradawl.

(e) Percussion and impelling tools:
hammers, screwdrivers, mallet.

(f) Holding and supporting tools:
cramps, cutting-board, vices, pincers.

2.2 Portable Power Tools

Identification, maintenance, safety and
uses of the following:-

(a) Planes - power hand planer, router
planer.

(b) Saws - Jig saw, circular saw.

(c) Sanders - orbital sander, belt
sander, drum sander, disc sander.

(d) Hand drill;

(e) Spray gun.

2.3 Special Purpose Hand Tools

Identification, classification, sketching,
maintenance, safety and uses of the
following:

(a) Planes: plough plane, compass
plane, router plane.

(b) Saws: coping saw, fret saw, bow
saw, compass saw, pad saw, junior
hacksaw.

(c) Boring bits: expansion bit,
forstner bit, countersink bit, auger
bit, centre bit, gimlet, brawdall, twist drill.

(d) Shapers: scrapers, rasps, surfers,
files.

3. WOODWORKING MACHINES

3.1 Types of Machines

Identification, functions of parts, uses
and safety precautions relating to the
listed machines:

(a) Grinding wheel.

(b) Circular saw bench, cross-cut
saw, bandsaw, dimension saw.

(c) Surfacers or jointers, thicknessers.

(d) Chainsaws, chisels, horizontal borer.

(e) Lathes, spindle moulder, drum
sander, jig saw, router.

(f) Drilling machine.

3.2 Safety Aids	Uses of guards, jigs, fences, push sticks, push blocks, gauges.
4. MATERIALS	
4.1 Timber	
4.1.1 Classification	(i) Hardwoods and softwoods (ii) Differences between hardwoods and structure.
4.1.2 Parts of a tree	(i) Identification and functions of the parts of a growing tree, i.e roots, trunk and crown. (ii) Identification and functions of the cross-sectional parts of a tree, i.e bark, bast, cambium layer, annual/growth rings, medullary rays, sapwood, heartwood and pith. (iii) Effects of the characteristics of the cross-sectional parts of a tree on timber for woodwork.
4.1.3 Surface quality of timber	Identification of timber by the following characteristics: (i) grain (i.e straight, inter-lock, wavy, diagonal, etc.). (ii) texture (iii) figure (iv) colour
4.1.4 Mechanic properties	Definition of the following properties: hardness, strength (i.e tensile, compressive and shear), elasticity, toughness.
4.1.5. Conversion of timber	Description and sketching of the following methods of conversion: (i) plain/through and through/live sawing; (ii) tangential/back/flat/rake sawing; (iii) quarter/radial/rift sawing; (iv) boxed-heart sawing.
4.1.6 Marketable size	Identification and sketching of the following marketable sizes: Log, baulk, plank, strip, batten, square, scantling, flitch, board.
4.1.7 Seasoning	Description of the following methods of seasoning: (i) natural or open air seasoning;

	(ii) artificial or kiln seasoning; (iii) water seasoning; (iv) chemical seasoning.
4.1.8 Determination of moisture content	Description of the following methods of determining moisture content: (i) oven dry method; (ii) moisture meter method.
4.1.9 Wood Preservation	(i) Reasons for preserving timber;
(ii) Types of preservatives - tar oil, water borne, organic solvent.	(iii) Qualities of an ideal preservative. (iv) Method of application: (I) Pressure treatment (i.e full cell and empty cell); (II) Non-pressure treatment (i.e spraying, impregnation, brushing, dipping, hot and cold treatment, steeping).
4.1.10 Defects in Timber	Identification, causes and sketching of the following types of defect in timber: (i) natural defects, e.g. knots, burr, grains. (ii) defects caused by organisms, e.g. rots, bores. (iii) wood processing defect, e.g. diagonal grain, upset, compression shakes. (iv) seasoning defects, e.g. splits, warp, shakes, honey combing, case hardening.
4.1.11 West African Timber	(i) Characteristics, similarities and differences, uses and working qualities of the following West African timbers: Iroko (Odum), Abura, Mahogany, Obeche (Wawa), Walnut, Afara, Ebony, Danta, Emery, Shedua, Mansonia, Afromosia (kokrodua), Avodire, Kusia. (ii) Effects of depletion of timber species
4.1.12 Veneers	Identification, description and sketching of the following: (i) Methods of production, i.e rotary, slicing, sawing. (ii) Types of veneers, i.e face, core and back veneers.

4.1.13	Manufactured boards	Identification, description, uses and sketching of: Plywood, blockboard, laminboard, chipboard, particle board, batten board, hardboard, fibre board.
4.2	Surface Decoration	Identification and sketching of tools: identification and description of the following methods of surface decoration: inlaying, veneering (hammer and caul, marquetry, laminated plastics, edging (i.e solid wood, plastics, metals, veneer), mouldings (i.e round, ovolo, reeding, carvetto/hollow, cyma recta/ogee, cyma reversa, scotia, bead, fluting), incised and relief carving.
4.3	<u>Non-Wood Material</u>	
4.3.1	Metals	(i) Classification: ferrous and non-ferrous. (ii) Types of ferrous metals: low carbon steel dead/mild steel. (iii) Types of non-ferrous metals: Aluminium, lead, copper, tin. (iv) Physical Properties of metals: hardness/softness. (v) Basic chemical characteristics of different metals.
4.3.2	Nails	Identification, description, uses and sketching of: French or wire nails; oval wire nails; lost-head nails; panel pin; veneer pin; cut tack; upholstery nails; roofing nails.
4.3.3	Screws	Identification, description, uses and sketching of: Countersunk head; raised head; round head; Philip's head; coach screws.
4.3.4	Plastics	(i) Types - thermosetting and thermoplastics. (ii) Differences between the types and their common properties. (iii) Items made from the two types of plastics. (iv) Uses of plastics.
4.3.5	Glass	Identification and uses of: opaque, transparent and decorative glasses.

- 4.3.6 Leather
- (i) Types - Natural and artificial.
 - (ii) Differences between the types.
 - (iii) Uses of leather, e.g furniture, belts, bags.
- 4.3.7 Abrasives
- Identification, uses and description of process of manufacture of glass paper and garnet paper.
- 4.3.8 Fittings
- Identification, description, uses and sketching of: locks; hinges; bolts; catches; castors; stays.
- 4.3.9 Adhesives
- Identification, characteristics, preparation and application, uses, safety precaution during application of:
- (i) Protein: animal, casein.
 - (ii) Synthetic: urea, phenol, melamine formaldehydes.
 - (iii) Contact: rubber based (Evostick).

5. SURFACE PREPARATION

- (a) Description of process, tools and materials required for various surface preparation: planing, scraping, sanding, filling, staining, bleaching, spraying and polishing.

6. FINISHES

- Types, characteristics, uses, methods application, safety precautions in the use of the following:-
- Paints, vanishes, lacquers, polishes, laminated plastics.

7. METHODS OF SHAPING AND BENDING WOOD

- Types and description of methods:
- (i) Obtaining sawn shapes from solid wood.
 - (ii) Shaping by lamination.
 - (iii) Shaping by curved bending.

8. WOODWORK JOINTS

- Classification, uses and sketching of the following:-
- (a) angle joints - mortice and tenon, dowel, dovetails, housing, halving, comb, plain mitre.
 - (b) widening joints - dowel, tongue and groove, loose tongue, rebated butt, slot screw, plain butt.

	(c) Framing joints:- mortice and tenon, bridle, mitre, dowelled, halving.
9. <u>UPHOLSTERY</u>	(a) <u>Tools</u> Identification, uses and sketching of the following:- tack hammer, strainer, curved and straight needle, tack remover, stapler, sewing machine, webbing stretcher, ripping chisel.
	(b) <u>Materials</u> Types, differences and uses of the following:- (i) Webbing - twine or cord, thread, spring, jute, hesian or baft. (ii) Padding - foam, kapok, feathers, coconut fibres. (iii) Covering - fabric, natural and artificial leathers. (iv) Tacking - stud, tack nails.
	(c) (i) Upholstery parts - frame, platform, studding/padding, covering. (ii) Types of platform (fixed and loose) and their uses.
10. <u>DESIGN ANDMAKING</u>	(a) Factors Affecting Design - Fitness for purpose, proportion, material, construction, finishing, cost. (b) (i) Problem identification and writing of brief. (ii) Stating conditions and constraints relating to suggested solution. (iii) Writing of specifications (i.e function, materials, construction, cost, ergonomics, aesthetics) for possible solutions.
	(c) Generating solutions: (i) Sources of information to generate ideas in solving problems, e.g. research, interviews, observations. (ii) Preliminary sketches – freehand sketching of designs. (d) Preparation of Solution: (i) drawing in isometric view; (ii) preparation of working

drawing in first and third angle orthographic projection;
(iii) preparation of cutting list.

(e) Estimation of the cost of materials.

(f) Making of the artefact:

(i) Preparation of the materials;

(ii) Construction of the artefact:

Working drawings should be related to the artefact

constructed;

- Tools are correctly used;
- Appropriate joints are used;
- Sequence of operation are followed;
- Safety precautions are observed;
- Appropriate finishes are applied;

(g) Evaluating the artefact: - the steps are:

(i) purpose of the artefact;

(ii) specifications of artefact;

(iii) whether the artefact serves the specifications;

(iv) strengths and weaknesses of artefact;

(v) areas of possible improvement;

(vi) judgment as to whether artefact

is excellent, good, satisfactory, poor.

11. MENSURATION

(a) Estimation, calculations involving linear, area, volume, percentage.

a job.

(b) Calculation of unit and total cost of

elements involved in costing of a

(c) Explanation of the various

overhead expenses, packaging, sales expenses, advertising, net profit, tax.

job; i.e materials, labour, portage,

12. WOOD TURNING

(a) The lathe – identification and function of parts and accessories: bed, stands, headstock, tailstock,

tool rest, centres, face plates.

uses and sketching of the following:

(b) Wood turning tools: identification

(i) scraping tools.

(ii) cutting tools.

(c) (i) Types of turning operations:

centres turning, boring.	face plate turning, between
	(ii) Articles produced from turning operations: flower vase, cup, egg holder, bowl, candle holder, decorative mouldings, Police baton, rolling pin, table legs.
13. <u>MASS PRODUCTION</u>	Explanation of stages in mass production:
	(a) Preparation of Design and Working drawings. (b) Preparation of workshop rod/ setting out.
	(c) Making of prototype. (d) Preparation of cutting list. (e) Preparation of materials. (f) Marking out using template. (g) Production of parts – use of jigs; division of labour. (h) Trial run. (i) Assembly line – trial assembly and final assembly. (j) Application of finishing. (k) Quality control.

RECOMMENDED TOOLS, MACHINES AND MATERIALS

FOR WOOD WORKSHOP

A. TOOLS

- (1) Rip saw
- (2) Cross-cut saw
- (3) Panel saw
- (4) Tenon saw
- (5) Dovetail saw
- (6) Coping saw
- (7) Pad saw
- (8) Firmer chisels, 6mm, 10mm, 12mm, 15mm, 20mm
- (9) Bevelled-edge chisels 6mm, 10mm, 12mm, 15mm, 20mm
- (10) Mortise chisels, 6mm, 100mm, 12mm, 15mm and 20mm
- (11) Gouges (Firmer and Scribing) 6mm, 12mm, 15mm, 20mm
- (12) Jack plane (metal)
- (13) Smoothing plane (metal)
- (14) Plough plane

- (15) Rebate plane
- (16) Shoulder plane
- (17) Block plane
- (18) Router plane
- (19) Bullnose plane
- (20) Compass plane
- (21) Spokes have (Round and flat)
- (22) Oil stone and slip stones
- (23) Oil can
- (24) Brace (Ratchet)
- (25) Bits (auger, centre, forstner, gimlet, bradawl, countersink sizes 6mm, 10mm,12mm, 20mm)
- (26) Hand drill
- (27) Hand scraper
- (28) Folding rule/Tape measure
- (29) Marking gauge
- (30) Cutting gauge
- (31) Mortise gauge
- (32) Wing compasses
- (33) Marking knife
- (34) Sliding bevel
- (35) Mitre square
- (36) Woodwork bench
- (37) Woodwork bench vice
- (38) Sash cramps
- (39) G-cramps.
- (40) Rack cramps
- (41) Try square
- (42) Warrington hammer
- (43) Claw hammer
- (44) Mallet
- (45) Pincers
- (46) Nail punches
- (47) Crowbar
- (48) Nail cutter
- (49) Glass cutter
- (50) Files
- (51) Rasps

B. WOODWORKING MACHINES

- (1) Cross-cut saw
- (2) Circular saw bench
- (3) Dimension saw
- (4) Band saw
- (26) Hand drill
- (27) Hand scraper
- (28) Folding rule/Tape measure
- (29) Marking gauge
- (30) Cutting gauge
- (31) Mortise gauge
- (32) Wing compasses

C. **PORTABLE POWER TOOLS**

- (1) Plane
- (2) Router
- (3) Jig saw
- (4) Circular saw
- (5) Power drill
- (6) Sanders (orbital, belt, disc)

D. **MATERIALS**

- (1) Timber
- (2) Adhesive
- (3) Abrasives
- (4) Nails
- (5) Screws
- (6) Finishes and Thinners
- (7) Plywood (different sizes)
- (8) Permanent Markers

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