

160 – SHIP BUILDING CRAFT PRACTICE

EXAMINATION STRUCTURE

The trade consists of the following trade related courses:

191 – General Metal Work

192 – General Wood Work

193 – Building/Engineering Drawing

EXAMINATION SCHEME

161 – Ship Building Craft

This subject grouping consists of two papers:

161-1 – PAPER I : This will consist of two sections, viz:

SECTION A: OBJECTIVE: this will be forty (40) multiple choice questions.

Candidates will be required to answer all in 40 minutes. This section carries forty (40) marks.

SECTION B: ESSAY: this will be a written paper of seven questions. Candidates are to answer five questions in 2 hours. This Section carries sixty (60) marks.

161-2 PAPER II – PRACTICAL: This will comprise of two (2) compulsory Practical Questions for a duration of three (3) hours; to be released to the candidates at least three days prior to the examination date. The paper carries 100 marks.

TOPIC/OBJECTIVES	CONTENTS	ACTIVITIES/REMARKS
1. DESIGN ELEMENTS AND PRINCIPLES Explain the meaning of design and the basic design elements. Apply design elements to various Operations.	<ol style="list-style-type: none"> 1. Meaning of Design. 2. The basic design element i.e. line-in-space, mock-up shape, colour form, and texture of materials. 3. How various elements affects the quality of a design in two and three dimensions. 4. Various design principles i.e. fairness division of lines, contrasted fairing, uniformity of form and emphasis on movement of materials. 5. Application of the above to the design elements. 6. Application of design elements and principles for some design operation. 	Understand the meaning of design and its elements. State the characteristics of the elements and how they affect the quality in two and three dimensions. Emphasize the application of design elements and principles.
2. SHIP BUILDING TERMS AND ABBREVIATIONS Explain various ship-building terms. Apply the terms to day-to-day ship management and construction.	<ol style="list-style-type: none"> 1. Various ship-building terms using sketches e.g. starboard, port, aft, abaft, artwarthship etc. 2. Definition of each of the above. 3. Various ship-building abbreviations e.g. PSFA, LOA, LBP B.EXT, D.EXT d.MID, B. MID D.EXT. etc. 4. The meaning of the abbreviations 	Understand various ship-building terms both in sketches and abbreviation. Recall some of the abbreviations and their uses. Discover more ship-building terms and why they are used.
3. TYPES AND PARTS OF SHIP Explain the various types and parts of ship. Observe the constructional Differences in various type of ship. Explain the usage of various types of ship.	<ol style="list-style-type: none"> 1. The different types of ship-general cargo, bull carrier, oil tanker, container, submarine tags, trawler etc. 2. The main features of the ships above. 3. The scope and operational functions of the ships mentioned above. 4. The various parts of the ship and midship sector. 5. The functions of each part of the ship. 6. Outlines of the ship profile mid-ship section and the plan. 	List the various types and parts of ship. Describe the midsection of each types of ship and differentiate one type of ship to the other. Sketch the ship profile and plan. Emphasize the uses of various types of ship.
4. SHIP BUILDING MATERIALS Describe the various ship building materials and their major area of usage.	<ol style="list-style-type: none"> 1. Common materials used in ship building e.g. naval brass, wood, reinforced plastic, steel wire, rope, glass and fibre glass. 2. The specific area of application of the materials. 3. The properties of the materials. 4. The advantages and disadvantages of the materials. 	List various common materials used in ship-building. List the properties of each materials and where each are commonly used. Emphasize the need to use correct material for a specific part of the ship. Identify the materials physically.
5. BASIC HAND TOOLS AND	<ol style="list-style-type: none"> 1. The various types of hand tools, 	Identify various hand and

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<p>POWERED TOOLS Explain the features and usage of various basic hand tools and powered tools. Describe the basic maintenance of the tools.</p>	<p>powered tools used in the ship building yard e.g. podger, spanner, guillotine, shears sledge hammers, mallets, power hacksaw etc.</p> <ol style="list-style-type: none"> The operational principles of each of the hand/powered tools, with special regard to safety. Usage and maintenance of the hand/powered tools. Sketching and identification of parts of the hand/powered tools. 	<p>powered tools used in ship building. Understand the operational principles of each of the hand/powered tools and use a hand and powered tools. Emphasize on safety when using the tools. Sketch and identify parts of hand and powered tools.</p>
<p>6. PATTERNS AND TEMPLATES Explain the meaning of patterns and templates and apply simple measurement to mark out simple ship parts. Describe the method of producing patterns and templates</p>	<ol style="list-style-type: none"> Definition of patterns and templates. Simple measurement and setting-out using datum and centre line. Marking-out and laying off of simple ship parts e.g. girder, gusset brackets, knee bracket etc. The three methods of development – radial, parallel and triangulation. Development of simple pattern template using wooden board, thick paper, cardboard paper, thin sheet materials etc. for the ship parts above. The properties, advantages and disadvantages of the materials in (5) above. Free hand drawings of objects in three dimensions e.g. block shape, funnel etc. 	<p>Understand the definition of patterns and templates with regards to the differences. Mark-out simple ship parts and apply the three methods of development. Develop simple pattern and template using various materials. Use free hand to sketch object in three dimensions.</p>
<p>7. SHIP STRUCTURE List parts of ship structure and identify the reasons for having those structures.</p>	<ol style="list-style-type: none"> Definition of the listed structure double bottom, framing, bulk-head, shell plating, decks, deck-house, pillars and girder, solid and bracket floor etc. The purpose of the listed structures above. Cross-sectional drawing showing details of various structure. The external and internal action on ship. 	<p>Know the definition of the listed structures and their application. Sketch the cross-sectional drawing highlighting the details.</p>
<p>8. FASTENING AND JOINING Describe the various principles of fastening and joining of parts of different shapes and sizes together using appropriate methods.</p>	<ol style="list-style-type: none"> Definition of fastening and joining. The properties of heat. The function of electric arc in welding. The principles of fusion welding metal arc method. Simple metal arc welding with down hard position on plates. Simple fillet welds-down 	<p>Understand the term fastening and joining as related to ship structure. List various properties of heat and the principles of fusion welding. Perform fillet welds in various positions of plates. Weld a simple box shapes. Know the various safety</p>

TOPIC/OBJECTIVES	CONTENTS	ACTIVITIES/REMARKS
	<p>position on plates and section.</p> <ol style="list-style-type: none"> 7. Simple open and close corner welds on simple box shapes. 8. The necessary safety precautions in the use of equipment and accessories with particular emphasis on earthing and insulation of appliances. 9. The gas welding equipment and accessories (high and low pressure equipment). 10. The various gases used for welding and cutting. 11. Flames type: neutral, carburizing and oxidizing flames. 12. The principles of non-fission welding. 13. Soft soldering. 14. Brazing and bronze welding. 15. The filler rods, fluxes used for various purposes. 16. The various gas welding techniques: leftward and rightward techniques. 17. Simple gas welding operations and cutting of plates sheets and other sections. 18. Construction of jigs of different designs, camber mould and other structures using electric arc, gas welding and cutting method. 19. Simple soldering work using blowlamp and tin lead. 	<p>precautions in the usage of electrical equipment use for welding.</p> <p>Identify various gas welding equipment and accessories and identify the three types of flames. Perform soft soldering brazing and bronze welding using filler rods and fluxes as appropriate. Perform various gas welding technique.</p>
<p>9. SIMPLE WORKING ON SHEETS PLATES AND ROLLED SECTIONS Identify common metals with bending tests and their properties. Describe the usage of machines used for bending and rolling of plates and sheets and the stiffening processes of sheet and plate.</p>	<ol style="list-style-type: none"> 1. Some common metals e.g. copper, zinc, aluminium, magnesium and manganese etc. 2. The physical chemical and mechanical properties of metals in (1) above. 3. The method of testing metals: bend test, impact test, hardness test etc. 4. Designing simple ship parts and structures. 5. Construction of the parts and structures using sheet, plates and rolled sections. 6. Rolling and bending of plates and sheets using pinch and pyramid type rolling machines. 7. Usage of fly press and other folding machines to produce simple shapes e.g. flanging, hemming, swaging etc. 8. Correct procedures of stiffening 	<p>Identify some common metals base on their properties. Test metals.</p> <p>Design and construct simple ship parts and structure using sheets, plates and rolled section. Use bending and rolling machines. Use fly press for folding. Carry out stiffening processes.</p>

TOPIC/OBJECTIVES	CONTENTS	ACTIVITIES/REMARKS
	of sheet and plate materials.	
10. SMITHING WORK AND RIVETTING Understand the term smithing and riveting and the procedure for hand and drop forging and riveting. Describe the various tools and equipment use for smithing work and riveting.	<ol style="list-style-type: none"> 1. The term smithing. 2. Hand and drop forging. 3. The various tools and equipment used in smithing work. 4. The various safety precautions to be observed in smithing and forging work. 5. Definition of Rivetting. 6. The types of rivet heads. 7. The specific functions of the various rivets and where each could be applied. 8. Carrying out simple smithing/ riveting operation. 	Identify various tools for riveting, smithing and forging. Know the specific functions of the various rivets and where each could be applied. Carryout simple smithing and riveting operation.
11. THEORY OF FLOATATION Explain the theory of floatation and Archimede's principles as applied to floating bodies. Describe free board and its advantages, the form taken by a ship subjected to various forces and the reaction of liquid load.	<ol style="list-style-type: none"> 1. Definition of the term floatation. 2. The Archimedean theory. 3. Archimedean principles as applied to floating bodies. 4. Definition of the term – free board. 5. The use and advantages of free board. 6. Co-efficient of forms e.g. block co-efficient, prismatic co-efficient, water plane area co-efficient. 7. The principles of load and centre of pressure on immersed plane. 8. Identification of the form taken by a ship subjected to the following forces: Hogging, sagging, racking, pounding, etc. 9. The reaction of liquid load on submerged planes, density, upthrust, buoyancy. 10. Development of patterns of buoys, vent hod, rectangular dust, etc. 	Define floatation and Archimedean theory of floatation as applied to floating bodies. Understand the term free board and the use of free board. Understand the co-efficient of forms and the principles of load and centre of pressure on immersed plane. Identify forms taken by a ship subjected to various forces. Emphasize on the patterns of buoys, vent hood etc.
12. MODELS OF SHIP PARTS List and identify various parts of the ship and describe their functions. Carry out the development, loft work of the parts and construct models of ship parts.	<ol style="list-style-type: none"> 1. The various parts of the ship: tanks, girder, boiler and engine seating brackets, panels of shell plating. 2. The ship parts and their functions. 3. Carrying out of the development, loft work and drawing of the parts in (2) above. 4. Construction of models of ship part in (1) above. 5. The principles of triangulation. 6. Description of simple transformer shape (transition piece) e.g. square to square, square to round, rectangle to 	List the various parts of the ship parts. Know the functions of each parts. Construct the model of ship parts. Understand and apply the principle of triangulation.

TOPIC/OBJECTIVES	CONTENTS	ACTIVITIES/REMARKS
	<p>round and off centre between planes.</p> <ol style="list-style-type: none"> 7. Fairing of sections, water lines buttock and boujean curves using line plans. 8. Carrying out simple triangulation frame work on the constructed models in (4) above. 	
<p>13. FASTENING AND JOINING List types of fastening method and their specific materials with emphasis on the use, care and maintenance of taps, wrenches and dies.</p>	<ol style="list-style-type: none"> 1. The types of fastening. 2. The types of screw thread forms. 3. The advantages and applications of the screw threads mentioned in (2) above. 4. The distinctions between parallel and taper threads. 5. Description with appropriate sketches, block and turned barrel bolt and high strength friction bolt. 6. Usage of stock and die to cut external thread. 7. Usage of tap and wrench to cut internal thread. 8. Description of grooved and knocked-up joints. 9. Construction of models with light gauges and the use of self secured joints. 10. Demonstration of proficiency in leftward and rightward techniques in gas welding. 11. The various types of joint and their position. 12. The various defects in welded joints and their causes. 13. The methods of testing welds: Destructive and non-destructive bend test, macro-etch test, visual inspection etc. 	<p>List various types of fastening method. Describe and identify various screw thread forms. Know the advantages and application of various screw thread forms. Demonstrate your proficiency in leftward and rightward gas welding technique. Identify various defects in welds and their causes. Test welds using various testing methods.</p>
<p>14. SHIP STRUCTURE Explain the features of the main structures of ship and their uses.</p>	<ol style="list-style-type: none"> 1. Definition of cargo space, double bottom tanks, fore and aft, peak tank, engine room, accommodation space, gangway, pump room, coffer dam etc. 2. The functions of the structures above. 3. The definition of the functions of bulk head, (transverse and longitudinal). 4. The functions of floors, beam, frames, web and girder. 5. The types of framings and their specific usage. 6. The functions of deck houses (super structures). 	<p>Define and list various ship structures and super structures. Know the differences between structures and super structures. Identify various functions of structures and super structures.</p>

TOPIC/OBJECTIVES	CONTENTS	ACTIVITIES/REMARKS
	7. The functions of stern and the ship rudder, gudgeons and pintles.	
15. ASSEMBLY PROCEDURES Explain in details the procedures for assembling ship structures. Understand the importance of alignment and the processes that enhance the rigidity of structures and super structures.	<ol style="list-style-type: none"> 1. The meaning of the following assembly terms: joining, plumbing, horning and leveling. 2. The importance of alignment of components. 3. The importance of accuracy in prefabricated work. 4. Method of imparting stiffness to plating-welded stiffness and rolled steel sections, troughing, swaging and flanging etc. 5. Explanation of scalloping, bending and leveling of frames. 6. Methods of controlling distortion and residual stress effect in welding. 7. The correct welds sequence and techniques: pre-setting, pre-cambering, tacking procedures etc. 	List and define various assembly terms. Understand the importance of alignment of components and methods of imparting stiffness to various materials. Describe the process of scalloping, bending and frame. Prevent distortion and residual stress in welding and carryout correct weld sequence and techniques.
16. SHIP BUILDING FACILITIES Describe the various ship building facilities and their purposes.	<ol style="list-style-type: none"> 1. The facilities for ship building e.g. building berth, slipway platers/fabrication workshop. 2. The facilities for ship repairs e.g. graving (dry) dock, floating dock, slipway. 	Explain various ship building facilities and how they are used. Visit a ship building yard.
17. THERMAL CUTTING Describe the processes of thermal cutting and electric arc welding. Explain the influence of certain factors on welding.	<ol style="list-style-type: none"> 1. The principles of thermal cutting using oxy-fuel gas method. 2. Performing electric arc cutting. 3. The influence of combustion temperature, melting point and fluidity of oxides. 4. Usage and maintenance of arc welding equipment and accessories. 	Understand the principles of thermal cutting. Carry out electric arc cutting. Know the influence of combustion temperature melting point and fluidity of oxides. Use and maintain arc welding equipment and accessories.
18. TEMPLATE/PATTERN MAKING AND LOFT WORK Explain the procedures of producing template involving complex shape designs and produce drawings of templates using several lines and angles.	<ol style="list-style-type: none"> 1. Carry out further work on template making involving complex designs. 2. Making lines on sections, lining-off-point lines on draught, free board and tonnage. 3. Making scaled fittings of mock models. 4. Identification of listed plans; body plan, sheer profile plan view etc. 5. The interrelationship between plans. 6. Graphical bisections and division of lines and angles. 	Produce template involving complex shape design. Draw diagrams using several types of lines. Identify plans as produced. Understand the interrelationship between plans.
19. BUILDING A SHIP	1. Definition of ship building terms.	List ship-building terms.

TOPIC/OBJECTIVES	CONTENTS	ACTIVITIES/REMARKS
Describe various ship building terms and demonstrate the practical knowledge of the listed building operations.	<ol style="list-style-type: none"> 2. The various operations and stages involved in building a ship. 3. Demonstration of the practical knowledge of the listed ship building operations. 4. The flow of material through a ship yard. 5. The event leading from initial enquiry to the completion of contract. 6. The advantages of unit fabrication. 7. An out door building berth. 8. Sketch of an out door building berth. 9. Types of ship yard cranes, where each crane could be used and their advantages. 	<p>Understand the operations and stages involved.</p> <p>Demonstrate the practical knowledge of the building operation.</p> <p>Understand the various stages of initiating and executing contract.</p> <p>Draw an out door building berth.</p> <p>Differentiate the various ship yard cranes and their uses.</p>
<p>20. DECK COVERING AND TESTING</p> <p>Explain the reasons for fitting deck covering and the method and type different types of deck composition.</p>	<ol style="list-style-type: none"> 1. The reasons for fitting deck covering. 2. The methods of fitting deck covering. 3. The types of timber used in deck coverings. 4. The types of deck compositions. 5. Layout for and arrangement of attaching wood sheathing to steel decks. 6. Methods of achieving water tightness in wood decking. 7. Methods of preventing corrosion in deck coverings. 8. The methods of achieving water tightness in steel decks. 9. Explanation of compressed air tightness. 10. Explanation of caulking, chipping, rewelding and gauging. 	<p>List the reasons for fitting deck covering.</p> <p>State the method, types of deck covering and composition.</p> <p>Sketch the layout for and arrangement of attaching wood sheathing to steel decks.</p> <p>State methods of achieving tightness and prevention of corrosion in deck coverings.</p>
<p>21. SHIP FITTINGS</p> <p>Identify various deck machinery and fittings and state their various uses, location on board the ship.</p>	<ol style="list-style-type: none"> 1. Identification of pieces of deck machinery and fittings: winch and windlass, capstans, bollards and fair leads etc. 2. The functions and location of each of the fittings above on board ship. 3. Listing buoyant apparatuses: life raft, inflatable rafts, life jackets etc. 4. Correct usage of the equipment listed in (3) above. 	<p>Identify deck machinery and list the various uses.</p> <p>Locate the machinery on the ship.</p> <p>List buoyant apparatuses and the usage.</p> <p>Demonstrate the correct usage of the buoyant apparatuses.</p>
<p>22. CLASSIFICATION SOCIETIES</p>	<ol style="list-style-type: none"> 1. The regulatory bodies involved in ship building industry e.g. 	<p>List regulatory bodies involved in ship building.</p>

TOPIC/OBJECTIVES	CONTENTS	ACTIVITIES/REMARKS
<p>Describe the roles and functions of regulatory bodies in ship building industry.</p>	<p>ABS, DNV. 2. The functions of the listed bodies. 3. Naming the classification of societies: DTI and International Bodies – International Maritime Organization (IMO), International Labour Organization (ILO), Ministry of Defence (Naval).</p>	<p>Explain their various specific functions. Name various classification societies.</p>
<p>23. SHIP STRUCTURE Explain the detailed arrangement of fore and aft construction and the shaft tunnel and stern tubes and other necessary ship structures.</p>	<p>1. Detailed arrangement of fore and aft construction. 2. Explanation of bulbous types and ram bows. 3. Description of shaft tunnels and stern tubes. 4. Functions of the structures listed in (3) above. 5. Detailed arrangement of midship section in single and double bottom vessels.</p>	<p>Describe the arrangement of fore and aft construction and the other ship structures. List the functions as listed and explain the arrangement of midship section both in single and double bottom vessels.</p>