

# Syllabus for Inland Vessel - 1<sup>st</sup> Class Engine Driver

**Preamble:** This syllabus has been designed keeping in mind that a 1<sup>st</sup> Class Engine Driver should be competent to undertake the responsibility of different types and sizes of vessels permitted for this grade.

## ***1. General and Marine Engineering***

- 1.1 Types of Ships and Inland Vessels:** - Types of Ships plying in harbor, coastal areas and ocean going vessels. Parts of the ships and general arrangements. Cargo spaces, tanks and constructional details of different type of ships employed as Inland Vessels. Types of propulsion and maneuvering methods.
- 1.2 General Section:** - Fundamental units of Work, Force, Power, Heat and Temperatures, Area, Volume, General Ship terms, Friction. Displacement, Dead weight, Light Weight, Density, Specific Gravity. Overall Length, Depth and Draft of ships.
- 1.3 Auxiliary machinery:** - Use and maintenance of different types of valves, fittings, pipe lines, connections and heat exchangers.
- 1.4 Air Compressors:** - Application and use of compressed air on ships. Basic knowledge of air compressor, its parts and its operation. Air receivers and fittings. Air distribution for starting of engines and auxiliary purposes including that for pneumatic machinery and control system. Procedure for maintenance of suction and delivery valves, relief valves, cut outs and safeties.
- 1.5 Pumps and pumping system:** - Types of pumps common found on small crafts and vessels (centrifugal pump, gear pump, reciprocating pump, and hand operated reciprocating and semi rotary pumps). Basic understanding of bilge and ballast system and its components. Starting and stopping procedures of pumps and observation while the pumps are operating.
- 1.6** Types of valves commonly used on small crafts and vessels (Globe valve, gate valve, ball valves and cocks)
- 1.7** Storage and safe handling of fuel oil and lubricating oils. Prevention of spills and oil fires.
- 1.8** Safe bunkering, ballasting and de-ballasting.
- 1.9 Lubricating oil and lubrication system:** - Purpose of lubrication and types of lubricants (oils and greases). Basic properties of Lubricating Oils. Basic components of a lubrication system. Importance of maintaining quality of lubricants. Working pressures and tripping pressures. Causes for loss of pressure. Sources of contaminants. Importance of maintaining filtration, prevention of leakages and monitoring consumption. Consequences of poor quality of lubrication and insufficient lubrications.

- 1.10 Diesel Engines and their Operation:** Principle of operation of internal combustion engine. Types of medium speed and high speed engines used on small crafts and vessels. Components of diesel engines and their function. Components of Fuel system, Lubricating oil system, Cooling Water System and different methods of starting the engine and reversing. Importance of clean air supply and maintenance of suction filters. Safety aspects related to exhaust system. Concepts of turbocharging. Importance of maintaining fuel system, prevention of leakage and fires related to fuel. Arrangements of reduction gears and clutch.
- 1.11** Knowledge and understanding of air starting system and reversing mechanism.
- 1.12** Preparation for starting of generator engine and other machinery.
- 1.13** Fuel injection systems, power balance, determining and maintaining efficient operation of engine.
- 1.14** Preparation for starting of main engine. Maintaining required speed and direction and responding to communication with the bridge. Ensuring smooth operation of the plant and maintaining parameters.
- 1.15** Applicant should be able to explain the actual working of engines and separate usages of the feed pumps, pistons and other appliances.
- 1.16** Should fully understand the working and management of motor engines and separate use of magnetos, carburetors, water circulating oil pumps, sparking plugs etc.
- 1.17 Trouble shooting:** Identifying change in operating parameters and taking timely corrective action. Finding faults and rectifying them.
- 1.18** Should be able to detect what is wrong in the event of the engine failing to startup or any accessories to perform its proper function.
- 1.19 Engineering Watch:** - Principles to be observed during a watch. Procedure of taking over and handing over a watch. Routine duties undertaken during a watch. Reading pressure gauges and thermometers. Reading electrical instruments.
- 1.20** Maintenance of machinery space log book and significance of the readings taken.
- 1.21** Writing instructions for other watch keepers.
- 1.22 Rudder, Propeller and Steering:** - Function of rudder and different types of operating mechanism used on small crafts and vessels. Basic components of steering gear system.
- 1.23** Propeller and shaft arrangements. Tail shaft, and tail shaft gland and seal arrangements. Importance of maintenance of tail shaft gland seal, and packing.
- 1.24** Dangers of flooding due to leakages from the tail shaft, pumps, and hull.

- 1.25** Understanding of different methods of steering small crafts and vessels (Ram type and rotary vane steering) and plant. Understanding of modern machinery such as rudder propellers and thrusters.
- 1.26 Deck Machinery:** - Familiarity with mooring equipment and anchors and anchor handling equipment. (Anchor, anchor chain, chain locker, capstan, windlass, and deck crane). Maintenance of Deck Machinery.
- 1.27 Hydraulic and Pneumatic machinery:-** Hydraulic power pack, flow control and direction control valves and motor, cleanliness of hydraulic oil for reliable operation, application of hydraulics in main engine clutch control, steering gear, windlass, and similar deck machinery.
- 1.28 General Engineering Knowledge:** Properties of materials, prevention of corrosion, protection and preservation of equipment. Type of paints and applicators.
- 1.29** Knowledge and skills for using lathe machines, drilling machine, grinders, arc welding unit, gas welding and gas cutting, pressure testing, hydraulic jacks, lifting devices, and safe working practices related to equipment.

## ***2. Electrical Engineering***

- 2.1 Basic Electrical Knowledge:** voltage, current, power units, concepts of resistance. Types of batteries and their maintenance (lead acid, alkaline battery and dry). Concept of plates, cells and voltage. Charging of batteries and battery chargers.
- 2.2** Use of hand tools, electrical and electronic measuring and test equipment, safety requirements for working on electrical systems. Ability to use instruments for testing electrical circuits (tester, Multi-meter, megger, clamp meter, ammeter and volt meter.)
- 2.3** Lighting and electrical distribution and switch board. Types of transformers and their maintenance. Emergency lighting and circuits. Engine Room alarms system and testing. Light, fuses, circuit breakers, trips and electrical sockets.
- 2.4** Knowledge and understanding of bridge equipment and basic fault finding. Fault finding and repair work related to ship's horn, hooters, navigation lights, etc.
- 2.5** Basic knowledge of AC and DC generators and motors.
- 2.6** Ability to read basic circuit diagrams and ability to find faults in electrical systems.
- 2.7** Basic knowledge of control system and electronics.
- 2.8** Safe methods of operating and maintaining electrical machinery.

### ***3. Maintenance and Repair***

- 3.1 Application of safe working practices in repair and maintenance.
- 3.2 Knowledge of different types of tools and instruments used for maintenance of machinery and equipment (Hand tools – types of spanners, hammers, screw drivers, pliers, chisels, files, hacksaw, socket and box spanners, bearing pullers, clamps.). Measuring equipment (Calipers, micrometer, ruler, straight edge, T-square)
- 3.3 Characteristics and limitations of materials used in the construction and repair of vessels and equipment, names of materials for construction of hull and machinery, wood, steel, aluminum, glass re-enforced plastic, cast iron, mild steel , cast steel, alloy steel, copper, zinc, tin and common alloys. Use of synthetic resin for temporary repair. Riveted, bolted and muff couplings. Soldering and brazing.
- 3.4 Ability to carry out repairs to deck fittings, use welding equipment, repair kits such as glass re-enforced plastic and resins.
- 3.5 Ability to undertake major overhaul and repair work related of diesel engines, generators and other essential equipment on board.
- 3.6 Shall be able to show how he would act in case of the breakdown of the any of the machinery on the vessel.

### ***4. Safety***

- 4.1 **Prevention of fire and Fire Fighting:-** Concept of fire theory. Combustible materials and their characteristics. Basic approach to prevention of fires. Firefighting equipment – pumps, hydrants, hoses, nozzles, types potable extinguishers and foam applicators. Techniques of fighting fires.
- 4.2 Should be able to realize the danger of fire and should understand the precaution necessary to prevent fire and what to do when fire breaks up.
- 4.3 **Life Saving Appliance:** Ability to use life jackets, life buoys and life rafts.
- 4.4 **First Aid Techniques:** Preserve and maintain First Aid equipment. Apply medical first aid in emergency situations.
- 4.5 **Safe Working Practices and Security aspects:** for different type of Inland Vessels – Tugs, Propelled barges, Passenger ferries, bunker barges and other coastal vessels under the purview of Inland vessels. Vigilance and maintaining security on vessels against theft, smuggling, and piracy.
- 4.6 **Protection of Marine Environment:** Appreciation for prevention of pollution of the environment. Sources of pollutants. Responsibility towards prevention of pollution and protection of environment. Measures for prevention of pollution from oils, chemicals, waste and machinery exhaust. Garbage Management Plan and proper disposal of garbage from the ship.

## **5. *Operational Management of resources and legislation***

- 5.1 Training of sub-ordinates:** Excepting responsibility for training subordinates. Appreciating importance of team work and team building.
- 5.2** Monitoring consumption of fuel, lubricants, water and other consumables. Maintaining records. Creating requisition for consumables and spares.
- 5.3** Awareness of different port rules and regulations and maintaining statutory requirements.
- 5.4** Ability to read and interpret instruction manuals, company guidelines and instructions.

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# Syllabus for Inland Vessel - 2nd Class Engine Driver

**Preamble:** This syllabus has been designed keeping in mind that a 2<sup>nd</sup> Class Engine Driver should be competent to undertake the responsibility on different types and sizes of vessels permitted for this grade.

## ***1. General and Marine Engineering***

- 1.30 Types of Ships and Inland Vessels:** - Types of Ships plying in harbor, coastal areas, and ocean going vessels. Parts of the ships and general arrangements. Cargo spaces, tanks, and constructional details of different type of ships employed as Inland Vessels. Types of propulsion and maneuvering methods.
- 1.31 Auxiliary machinery:** - Use and maintenance of different types of valves, fittings, pipe lines, connections and heat exchangers. Types of valves commonly used on small crafts and vessels (Globe valve, gate valve, ball valves, and cocks)
- 1.32 Air Compressors:** - Application and use of compressed air on ships. Basic knowledge of air compressor, its parts, and its operation. Air receivers and fittings.
- 1.33 Pumps and pumping system:** - Types of pumps common found on small crafts and vessels (centrifugal pump, gear pump, reciprocating pump, and hand operated reciprocating and semi rotary pumps). Basic understanding of bilge and ballast system and its components. Starting and stopping procedures of pumps and observation while the pumps are operating.
- 1.34** Storage and safe handling of fuel oil and lubricating oils. Prevention of spills, and oil fires.
- 1.35** Basic knowledge of bunkering, ballasting and de-ballasting.
- 1.36** Should be able to explain his duties in case of breakdown of engine or any other machinery.
- 1.37 Lubricating oil and lubrication system:** - Purpose of lubrication and types of lubricants (oils and greases). Knowledge of different grades of oils and their specific use.
- 1.38 Diesel Engines and their Operation:** Principle of operation of internal combustion engine. Types of medium speed and high speed engines used on small crafts and vessels. Naming components of diesel engines and their function. Different methods of starting the engine and reversing. Importance of clean air supply and maintenance of suction filters. Safety aspects related to exhaust system. Concepts of turbocharging. Importance of maintaining fuel system, prevention of leakage, and fires related to fuel. Arrangements of reduction gears and clutch.

- 1.39 Knowledge and understanding of air starting system and reversing mechanism.
- 1.40 Preparation for starting of generator engine and other machinery. Maintaining required speed and direction, and responding to communication with the bridge. Ensuring smooth operation of the plant and maintaining parameters.
- 1.41 **Trouble shooting:** Identifying change in operating parameters and taking timely corrective action. Finding faults and rectifying them.
- 1.42 **Engineering Watch:** - Principles to be observed during a watch, Procedure of taking over and handing over a watch, Routine duties undertaken during a watch. Reading pressure gauges and thermometers.
- 1.43 **Rudder and Propeller:** - Function of rudder, and different types of operating mechanism used on small crafts and vessels. Basic components of steering gear system.
- 1.44 Damage of flooding due to leakages from the tail shaft, pumps and hull.
- 1.45 **Deck Machinery:** - Familiarity with mooring equipment and anchors and anchor handling equipment. (Anchor, anchor chain, chain locker, capstan, windlass, and deck crane). Maintenance of Deck Machinery.
- 1.46 **General Engineering Knowledge:** Type of paints and applicators.

## ***2. Electrical Engineering***

- 2.1 **Basic Electrical Knowledge:** voltage, current, power units, concepts of resistance. Types of batteries and their maintenance (lead acid, alkaline battery and dry). Charging of batteries and battery chargers.
- 2.2 Safety requirements for working on electrical systems.
- 2.3 Lighting and electrical distribution and switch board. Light, fuses, circuit breakers, trips, and electrical sockets.
- 2.4 Basic knowledge of AC generators and motors.
- 2.5 Fault finding and repair work related to ship's horn, hooters, navigation lights, etc.
- 2.6 Safe methods of operating and maintaining electrical machinery.

### ***3. Maintenance and Repair***

- 3.1 Application of safe working practices in repair and maintenance.
- 3.2 Knowledge of different types of tools and instruments used for maintenance of machinery and equipment (Hand tools – types of spanners, hammers, screw drivers, pliers, chisels, files, hacksaw, socket and box spanners, bearing pullers, clamps.). Measuring equipment (Calipers, micrometer, ruler, straight edge, T-square)
- 3.3 Ability to carry out repairs to deck fittings, Deck plates, and leaky pipes valves.

### ***4. Safety***

- 4.1 **Prevention of fire and Fire Fighting:** - Concept of fire theory. Combustible materials and their characteristics. Basic approach to prevention of fires. Firefighting equipment – pumps, hydrants, hoses, nozzles, types of portable extinguishers, and foam applicators. Techniques of fighting fires.
- 4.2 **Life Saving Appliance:** Ability to use life jackets, life buoys, and life rafts.
- 4.3 **First Aid Techniques:** Preserve and maintain First Aid equipment. Apply medical first aid in emergency situations.
- 4.4 **Safe Working Practices and Security aspects:** for different type of Inland Vessels – Launches, Tugs, Propelled barges, Passenger ferries, bunker barges and other coastal vessels under the purview of Inland vessels. Safe practices during smoking / oil transferring. Vigilance and maintaining security on vessels against theft, smuggling, and piracy.
- 4.5 **Protection of Marine Environment:** Appreciation for prevention of pollution of the environment. Sources of pollutants. Responsibility towards prevention of pollution and protection of environment. Measures for prevention of pollution – from, oils, chemicals, waste and machinery exhaust.
- 4.6 Should know sources of fire and their precautionary / preventive measures and also should be able to realize the danger of fire and should understand the precaution necessary to prevent fire and what to do when fire breaks up.

### ***5. Operational Management of resources and legislation***

- 5.1 Monitoring consumption of fuel, lubricants, water, and other consumables.
- 5.2 Awareness of different port rules and regulations and maintaining statutory requirements.

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# Syllabus for Engineer of - Inland Vessel (IV)

**Preamble:** This syllabus has been designed keeping in mind that as a Licensed Engineer should be competent to undertake the responsibility of the position on different types and sizes of vessels permitted for this grade.

## ***1. General and Marine Engineering***

- 1.47 Types of Ships and Inland Vessels:-** Types of Ships plying in harbor, coastal areas and ocean going vessels. Parts of the ships and general arrangements. Cargo spaces, tanks and constructional details of different type of ships employed as Inland Vessels. Types of propulsion and maneuvering methods.
- 1.48 General Section:** - Fundamental units of Work, Force, Power, Heat and Temperatures, Area, Volume, General Ship terms, Friction. Displacement, Dead weight, Light Weight, Density, Specific Gravity. Overall Length, Depth, and Draft of ships.
- 1.49 Auxiliary machinery:** - Use and maintenance of different types of valves, fittings, pipe lines, connections and heat exchangers.
- 1.50 Air Compressors:** - Application and use of compressed air on ships. Basic knowledge of air compressor, its parts and its operation. Air receivers and fittings. Air distribution for starting of engines and auxiliary purposes including that for pneumatic machinery and control system. Procedure for maintenance of suction, relief valve, delivery valves and air receiver.
- 1.51 Pumps and pumping system:** - Types of pumps common found on small crafts and vessels (centrifugal pump, gear pump, reciprocating pump, and hand operated reciprocating and semi rotary pumps). Basic understanding of bilge and ballast system and its components. Starting and stopping procedures of pumps and observation while the pumps are operating. Over hauling of different types of pumps.
- 1.52** Types of valves commonly used on small crafts and vessels (Globe valve, gate valve, ball valves, and cocks)
- 1.53** Storage and safe handling of fuel oil and lubricating oils. Prevention of spills, and oil fires.
- 1.54** Safe bunkering, ballasting and de-ballasting.
- 1.55 Lubricating oil and lubrication system:** - Purpose of lubrication and types of lubricants (oils and greases). Basic properties of Lubricating Oils. Basic components of a lubrication system. Importance of maintaining quality of lubricants. Working pressures and tripping pressures. Causes for loss of pressure. Sources of contaminants. Importance of maintaining filtration, prevention of leakages and monitoring consumption. Consequences of poor quality of lubrication and insufficient lubrications.

- 1.56 Diesel Engines and their Operation:** Principle of operation of internal combustion engine. Types of medium speed and high speed engines used on small crafts and vessels. Components of diesel engines and their function. Components of Fuel system, Lubricating oil system, Cooling Water System and different methods of starting the engine and reversing. Importance of clean air supply and maintenance of suction filters. Safety aspects related to exhaust system. Concepts of turbocharging. Importance of maintaining fuel system, prevention of leakage and fires related to fuel. Arrangements of reduction gears and clutch.
- 1.57** Knowledge and understanding of air starting system and reversing mechanism.
- 1.58** Preparation for starting of generator engine and other machinery.
- 1.59** Fuel injection systems, power balance, determining and maintaining efficient operation of engine.
- 1.60** Preparation for starting of main engine. Maintaining required speed and direction and responding to communication with the bridge. Ensuring smooth operation of the plant and maintaining parameters.
- 1.61** Applicant should be able to explain the actual working of engines and separate usages of the feed pumps, pistons and other appliances.
- 1.62** Should fully understand the working and management of motor engines and separate use of magnetos, carburetors, water circulating oil pumps, sparking plugs etc.
- 1.63 Trouble shooting:** Identifying change in operating parameters and taking timely corrective action. Finding faults and rectifying them.
- 1.64** Should be able to detect what is wrong in the event of the engine failing to startup or any accessories to perform its proper function.
- 1.65 Engineering Watch:** - Principles to be observed during a watch. Procedure of taking over and handing over a watch. Routine duties undertaken during a watch. Reading pressure gauges and thermometers. Reading electrical instruments.
- 1.66** Maintenance of machinery space log book and significance of the readings taken.
- 1.67** Writing instructions for other watch keepers.
- 1.68 Rudder, Propeller and Steering:** - Function of rudder and different types of operating mechanism used on small crafts and vessels. Basic components of steering gear system.
- 1.69** Propeller and shaft arrangements. Tail shaft and tail shaft gland and seal arrangements. Importance of maintenance of tail shaft gland seal and packing.
- 1.70** Dangers of flooding due to leakages from the tail shaft, pumps and hull.

- 1.71** Understanding of different methods of steering small crafts and vessels (Ram type and rotary vane steering) and plant. Understanding of modern machinery such as rudder propellers and thrusters.
- 1.72 Deck Machinery:** - Familiarity with mooring equipment and anchors and anchor handling equipment. (Anchor, anchor chain, chain locker, capstan, windlass and deck crane). Maintenance of Deck Machinery.
- 1.73 Hydraulic and Pneumatic machinery:** - Hydraulic power pack, flow control and direction control valves and motor, cleanliness of hydraulic oil for reliable operation, application of hydraulics in main engine clutch control, steering gear, windlass and similar deck machinery.
- 1.74 General Engineering Knowledge:** Properties of materials, prevention of corrosion, protection and preservation of equipment. Type of paints and applicators.
- 1.75** Knowledge and skills for using lathe machines, drilling machine, grinders, arc welding unit, gas welding and gas cutting, pressure testing, hydraulic jacks, lifting devices, and safe working practices related to equipment.

## ***2. Electrical Engineering***

- 2.1 Basic Electrical Knowledge:** voltage, current, power units, concepts of resistance. Types of batteries and their maintenance (lead acid, alkaline battery and dry). Concept of plates, cells and voltage. Charging of batteries and battery chargers.
- 2.2** Use of hand tools, electrical and electronic measuring and test equipment, safety requirements for working on electrical systems. Ability to use instruments for testing electrical circuits (tester, Multi-meter, megger, clamp meter, ammeter and volt meter.)
- 2.3** Lighting and electrical distribution and switch board. Types of transformers and their maintenance. Emergency lighting and circuits. Engine Room alarms system and testing. Light, fuses, circuit breakers, trips, and electrical sockets.
- 2.4** Knowledge and understanding of bridge equipment and basic fault finding. Fault finding and repair work related to ship's horn, hooters, navigation lights, etc.
- 2.5** Basic knowledge of AC and DC generators and motors and their construction.
- 2.6** Ability to read basic circuit diagrams and ability to find faults in electrical systems.
- 2.7** Basic knowledge of control system and electronics.
- 2.8** Safe methods of operating and maintaining electrical machinery.

### ***3. Maintenance and Repair***

- 3.1 Application of safe working practices in repair and maintenance.
- 3.2 Knowledge of different types of tools and instruments used for maintenance of machinery and equipment (Hand tools – types of spanners, hammers, screw drivers, pliers, chisels, files, hacksaw, socket and box spanners, bearing pullers, clamps.). Measuring equipment (Calipers, micrometer, ruler, straight edge, T-square)
- 3.3 Characteristics and limitations of materials used in the construction and repair of vessels and equipment, names of materials for construction of hull and machinery, wood, steel, aluminum, glass re-enforced plastic, cast iron, mild steel , cast steel, alloy steel, copper, zinc, tin and common alloys. Use of synthetic resin for temporary repair. Riveted, bolted and muff couplings. Soldering and brazing.
- 3.4 Ability to carry out repairs to deck fittings, use welding equipment, repair kits such as glass re-enforced plastic and resins.
- 3.5 Ability to undertake major overhaul and repair work related of diesel engines, generators and other essential equipment on board.
- 3.7 Shall be able to show how he would act in case of the breakdown of the any of the machinery on the vessel.

### ***4. Safety***

- 4.1 **Prevention of fire and Fire Fighting:** - Concept of fire theory. Combustible materials and their characteristics. Basic approach to prevention of fires. Firefighting equipment – pumps, hydrants, hoses, nozzles, types of portable extinguishers and foam applicators. Techniques of fighting fires
- 4.2 Should be able to realize the danger of fire and should understand the precaution necessary to prevent fire and what to do when fire breaks up.
- 4.3 **Life Saving Appliance:** Ability to use life jackets, life buoys and life rafts.
- 4.4 **First Aid Techniques:** Preserve and maintain First Aid equipment. Apply medical first aid in emergency situations.
- 4.5 **Safe Working Practices and Security aspects:** for different type of Inland Vessels – Tugs, Propelled barges, Passenger ferries, bunker barges and other coastal vessels under the purview of Inland vessels. Vigilance and maintaining security on vessels against theft, smuggling, and piracy.
- 4.6 **Protection of Marine Environment:** Appreciation for prevention of pollution of the environment. Sources of pollutants. Responsibility towards prevention of pollution and protection of environment. Measures for prevention of pollution from oils, chemicals, waste and machinery exhaust. Garbage Management Plan and proper disposal of garbage from the ship.

## **5. *Operational Management of resources and legislation***

- 5.1 Training of sub-ordinates:** Excepting responsibility for training subordinates. Appreciating importance of team work and team building.
- 5.2** Monitoring consumption of fuel, lubricants, water and other consumables. Maintaining records. Creating requisition for consumables and spares.
- 5.3** Awareness of different port rules and regulations and maintaining statutory requirements.
- 5.4** Ability to read and interpret instruction manuals, company guidelines and instructions.

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