ANNEX B OF CMO NO. 20, SERIES OF 2015
BACHELOR OF SCIENCE IN MARINE TRANSPORTATION
COURSE SPECIFICATIONS

Course Code	**:**	Mar Power
Course Descriptive Title	**:**	Basic Marine Engineering
Course Credits	**:**	4 units
Lecture Contact Hours per Week	**:**	4 hours
Laboratory Contact Hours per Week	**:**	0 hour
Prerequisite	**:**	n/a
Reference/s	**:**	1. Table A-II/2 of the 1978 STCW Code as amended Function: Navigation at the management level 2. IMO Model Course 7.01 3. Annex A of CMO No. 20, Series of 2015 (Curriculum Mapping for BSMT)

COMPETENCE	KNOWLEDGE, UNDERSTANDING AND PROFICIENCY	TOPICS	APPROX HOURS
Function: Navigation at the management level Operate remote controls of propulsion plant and engineering systems and services	– **Operating principles of marine power plants (1.11.1)**	<u>Diesel Engines</u> o Uses generally accepted engineering terms o Describes the 2-stroke diesel cycle o Describes the 4-stroke diesel cycle o Describes the operating principles of marine diesel engine propulsion plant o Describes the advantages and disadvantages of a slow-speed diesel engine o Explains the cause of scavenge fires and how they are dealt with o Describes methods of supercharging o Describes the fuel oil system from bunker tank to injection o Describes the lubrication system o Describes engine cooling-water systems o Describes the advantages and disadvantages of a medium-speed diesel o Explains the need for gearing with medium-speed diesels o Describes the arrangement of clutch and turning gears o Describes how a diesel engine is prepared for stand-by o Describes the method of starting, stopping and reversing of a direct propulsion diesel engine o States that the number of starts is limited by the capacity of the starting air reservoir	25 hours

COMPETENCE	KNOWLEDGE, UNDERSTANDING AND PROFICIENCY	TOPICS	APPROX HOURS
		○ Describes the waste heat recovery system of the 2-stroke main propulsion engine <u>Steam Turbine Systems</u> ○ Describes the turbine, the feed system and the boiler as a system ○ Explains the working of an impulse turbine and a reaction turbine ○ Describes a steam turbine installation and its gearing ○ Distinguishes between and describes open and closed feed systems ○ States that a steam turbine needs a large water-tube boiler ○ Describes the main features of a water-tube boiler ○ Describes in outline the procedure for raising steam ○ Describes the procedure for warming through a steam turbine ready for manoeuvring ○ Describes the procedures for manoeuvring when using a steam turbine <u>Gas Turbine System</u> ○ Describes the gas turbine system ○ Describes the compressor part of the gas turbine	

COMPETENCE	KNOWLEDGE, UNDERSTANDING AND PROFICIENCY	TOPICS	APPROX HOURS
		○ Describes the combustion chamber or combustor part of the gas turbine ○ Describes the turbine part of the gas turbine ○ Describes the two main types of compressors <u>Propeller and Propeller Shaft</u> ○ Describes the arrangement of thrust shaft, intermediate shafts and tailshaft ○ Explains how propeller thrust is transmitted to the hull ○ Describes how the propeller shaft is supported between the thrust block and the stern tube ○ Sketches and describes an oil-lubricated stern-tube bearing ○ Describes how the propeller is secured to the tailshaft ○ Defines pitch, slip and efficiency of a propeller ○ Calculates the percentage apparent slip from given data ○ Calculates the ship's speed, given the engine revolutions per minute, mean pitch and percentage slip ○ Describes the arrangement and operation of a controllable-pitch propeller (CPP) ○ States the precautions to take with a CPP before: – starting the main engines – going to sea	

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		– entering harbour or confined waters o States that changing control positions and the use of emergency hand control pitch and engine revolutions should be exercised <u>Bridge Control</u> o Describes a control system for the main engine, including control from bridge, machinery control room, engine control local and changeover controls o Describes bridge control of controllable-pitch propellers o Describes bridge control of slow speed diesel engines o Describes bridge control of steam turbines with associated boilers o Describes bridge control for gas turbines with associated gas generators o Lists the indicators and alarms provided with bridge control o Describes the arrangement and operations of lateral thrusters o Describes the bridge control and indicators for lateral thrusters o Describes the concept of control systems o Describes the terminology used in control systems o Explains when is the control system fail-safe‘	

COMPETENCE	KNOWLEDGE, UNDERSTANDING AND PROFICIENCY	TOPICS	APPROX HOURS
		○ Explains when is the control system fail-run‘ ○ Explains the meaning of safety interlocks in a control system ○ Describes the types of controls (open and closed loop)	
	Ship’s Auxiliary Machinery (1.11.2)	<u>Auxiliary Steam Systems</u> ○ Distinguishes between water-tube and fire-tube boilers ○ Describes auxiliary boilers ○ Describes a waste-heat boiler ○ Describes exhaust-gas heat exchangers ○ Describes steam-to-steam generators and explains where and why they are used ○ Describes a boiler fuel oil supply system ○ Describes the effect of dissolved salts in the feedwater and how it is treated ○ Explains what is meant by 'priming' ○ States that carry-over of water may cause serious damage to turbine blading and to steam cylinders <u>Distillation and Fresh-water Systems</u> ○ Describes a distillation system ○ Explains the operation of a flash evaporator	25 Hours

COMPETENCE	KNOWLEDGE, UNDERSTANDING AND PROFICIENCY	TOPICS	APPROX HOURS
		○ Describes the treatment of fresh water intended for drinking ○ Describes a domestic water system <u>Pumps and Pumping Systems</u> ○ Classifies pumps as displacement, axial-flow or centrifugal ○ Describes the operation of a reciprocating pump ○ Describes rotary displacement pumps and states typical applications ○ Describes a screw pump and states possible uses ○ Describes an axial-flow pump and states possible applications ○ Describes a centrifugal pump and states typical applications ○ Explains the need to prime a centrifugal pump ○ Describes the head losses in a pumping system and how they are expressed ○ Explains net positive suction head and its significance in pump operation ○ Describes a typical bilge system and ballast system for a dry cargo vessel ○ States that the engine-room emergency bilge suction is connected to the main circulating pump in the engine-room	

COMPETENCE	KNOWLEDGE, UNDERSTANDING AND PROFICIENCY	TOPICS	APPROX HOURS
		Steering Gear o Describes ram-type hydraulic steering gear o Describes rotary-vane steering gear o Explains how hydraulic power is provided by variable-delivery pumps o Describes the IMO requirements for auxiliary steering gear and how they are met by ram-type and rotary-vane steering gear o Describes a telemotor control system o Describes electric steering control o Explains how the change from remote to local control in the steering-gear compartment is made o Describes the requirement for power supplies to electric and electrohydraulic steering gear o Describes the requirements for emergency control of the steering gear o States the IMO requirements for testing steering gear and for drills Generators, Alternators and Electrical Distribution o Describes the operation of a D.C. generator o Explains the functioning of shunt- and compound-wound D.C. motors o Describes the operation of an alternator o Explains the functioning of induction motors	

COMPETENCE	KNOWLEDGE, UNDERSTANDING AND PROFICIENCY	TOPICS	APPROX HOURS
		○ Explains the relative advantages and disadvantages of generation and distribution of D.C. and A.C. ○ Describes D.C. and A.C. distribution systems ○ Describes the use of circuit-breakers and fuses ○ Describes and draws a navigation light circuit with indicators and alarm, showing an alternative power supply ○ Descries the use of rectifiers ○ Describes the characteristics of lead-acid batteries and of alkaline batteries ○ Describes the maintenance of batteries ○ Describes the safety precautions to be observed for battery compartments ○ outlines the starting requirements for emergency generating sets ○ Lists the services to be supplied from the emergency generator ○ Describes the supplementary emergency lighting for ro-ro passenger ships <u>Refrigeration, Air-conditioning and Ventilation</u> ○ Describes a vapour-compression-cycle refrigeration plant ○ States desirable properties of a refrigerant ○ States the properties of commonly used refrigerants	

COMPETENCE	KNOWLEDGE, UNDERSTANDING AND PROFICIENCY	TOPICS	APPROX HOURS
		○ Describes the use of secondary refrigerants for cooling compartments ○ Explains the co-efficient of performance of a refrigeration plant ○ Describes an air-conditioning plant ○ Describes a ventilation system for accommodation ○ Describes a mechanical ventilation system for ships' holds <u>Stabilisers</u> ○ Describes the construction and operation of fin stabilizers ○ Describes the arrangement and operation of a flume stabiliser <u>Sewage Treatment Plants</u> ○ Describes the operation of a chemical sewage treatment plant ○ Describes the operation of a biological sewage treatment plant <u>Oily-water Separators and Oil Filtering Equipment</u>	

COMPETENCE	KNOWLEDGE, UNDERSTANDING AND PROFICIENCY	TOPICS	APPROX HOURS
		o Describes the operation of an oily-water separator (producing effluent that contains less than 100 ppm of oil) o Describes the operation of oil filtering equipment (producing effluent that contains not more than 15 ppm of oil) o Explains why oily-water separators, even if well maintained and correctly operated, may not function properly o Describes how an oil-content meter functions o Describes an oil discharge monitoring and control system <u>Incinerators</u> o Describes the functioning of a waste incinerator <u>Deck Machinery</u> o States that the design and performance of anchor windlasses is subject to approval by a classification society o Sketches and describes a windlass driving two de-clutchable cable lifters and warping drums o Explains the gearing necessary between the prime mover and cable lifters o States that both winches may be coupled mechanically to provide either a stand-by drive, in case one prime mover should fail, or the	

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		power of both prime movers on one windlass, if required o Describes the arrangement of vertical anchor capstans with driving machinery below deck o Describes a spooling device to distribute the wire evenly on the drum of a mooring winch o Explains the working of self-tensioning winches o Briefly explains the advantages and disadvantages of steam, electric and hydraulic drive for mooring winches and capstans o Describes a cargo winch o Sketches and describes a slewing deck crane, its motors and its controls o Describes the lubrication of deck machinery <u>Hydraulic Systems</u> o States that a hydraulic system consists of an oil tank, pumps, control valves, hydraulic motors and pipework o Distinguishes between open- and closed-loop systems o Describes a live-line circuit supplied by a centralized hydraulic power system o Describes radial-piston and axial-piston variable-stroke pumps o Explains how the variable-stroke pump can act as controller and power supply	

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		○ Sketches and describes a simple spool valve with shutoff and control of flow direction ○ Describes ram and rotary-vane actuators ○ States that hydraulic systems can provide stepless control of speed for winches, cranes and other lifting devices ○ Describes a hydraulic accumulator and explains its purpose ○ States that cooling of the hydraulic oil is necessary during operation to maintain the correct viscosity of the oil ○ States that the oil may need to be heated before starting from cold ○ States that cleanliness of the oil is essential for satisfactory operation and that all systems contain filters ○ States that air in a system leads to erratic functioning	
	General Knowledge of Marine Engineering Systems (1.11.3)	Marine Engineering Terms and Fuel Consumption (1.11.3.1) ○ Uses the correct engineering terms when describing and explaining the operation of the machinery and equipment mentioned above ○ Defines mass, force, work, power, energy, pressure, stress, strain and heat and states the units in which each is measured	8 Hours

COMPETENCE	KNOWLEDGE, UNDERSTANDING AND PROFICIENCY	TOPICS	APPROX HOURS
		○ Explains what is meant by the efficiency of machine ○ Describes an indicator diagram and the information obtainable from it ○ Defines indicated power, shaft power, propeller power and thrust ○ Defines the Admiralty coefficient (AC) as: ○ $AC = \frac{(\text{displacement})^{2/3} \times (\text{speed})^3}{\text{engine power}}$ ○ Defines the fuel coefficient (FC) as: ○ $FC = \frac{(\text{displacement})^{2/3} \times (\text{speed})^3}{\text{daily fuel consumption}}$ ○ Explains that for a given period of time: ○ $\frac{\text{fuel consumption}^1}{\text{fuel consumption}^2} = \left[\frac{\text{displacement}^1}{\text{displacement}^2}\right]^{2/3} \times \left[\frac{\text{speed}^1}{\text{speed}^2}\right]^3$ ○ Explains that for a given distance: ○ $\frac{\text{fuel consumption}^1}{\text{fuel consumption}^2} = \left[\frac{\text{displacement}^1}{\text{displacement}^2}\right]^{2/3} \times \left[\frac{\text{speed}^1}{\text{speed}^2}\right]^2$ ○ Explains that: ○ $\frac{\text{Voyage consumption}^1}{\text{Voyage consumption}^2} = \left[\frac{\text{displacement}^1}{\text{displacement}^2}\right]^{2/3} \times \left[\frac{\text{speed}^1}{\text{speed}^2}\right]^2 \times \frac{\text{Voyage distance}^1}{\text{Voyage distance}^2}$ ○ Given data from the previous performance, calculates: ○ — the daily consumption at service speed ○ — the bunker fuel required for a voyage ○ — the speed for a given daily consumption	

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		○ – the reduced speed required to complete a voyage with a given consumption ○ Explains that, for fuel economy, the actual speed at any stage of a voyage should be as near as practicable to the required average speed ○ Explains how the condition of the hull affects the fuel coefficient and the fuel consumption ○ Explains that keeping the leading edges and tips of propeller blades dressed and polished improves propeller efficiency and reduces fuel consumption Arrangements necessary for appropriate and effective engineering watches to be maintained for the purpose of safety under normal circumstances and ums operations. ○ Explains briefly the general engine room safety that should be observed at all given times ○ Describes the main dangers and sources of risk in an engine room ○ Explains the importance and implementation of risk assessment and risk management in an engine room ○ Describes the safe systems of work and permits to work that should be observed in an engine room	

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		○ Explains the types and importance of wearing personal protective equipment (PPE) while working in an engine room ○ Describes the arrangements necessary for appropriate and effective engineering watches to be maintained for the purpose of safety under normal circumstances and UMS operations Arrangements necessary to ensure a safe engineering watch is maintained when carrying dangerous cargo Describes the arrangements necessary to ensure a safe engineering watch is maintained when carrying dangerous cargo	
		Total	58