GUJARAT TECHNOLOGICAL UNIVERSITY

Subject Name: MARINE INTERNAL COMBUSTION ENGINE-1
Course Code :(3351801)

Diploma Programme in which this course is offered	Semester in which offered
Marine Engineering	5th Semester

1. RATIONALE

For a marine engineer it is utmost importance to understand about the working of engines & to read the parameters of engine so as to operate an engine efficiently. By understanding the working of engines a Marine engineer can be able to troubleshoot and rectify problems onboard.

2. COMPETENCY

At the end of the study of Vth Semester the student will be able to

- Differentiate between 4 stroke & 2 stroke.
- Understand the working of Marine propulsion system.
- Steam machinery plants & thermal efficiency & combined steam & gas plant.
- Study about scavenging & its types.
- Acquire broader ideas about working of turbocharger
- Study of fuels & lubricants used in combustion .

3. TEACHING AND EXAMINATION SCHEME

Teaching Scheme (In Hours)			Total Credits (L+T+P)	Examination Scheme				
				Theory Marks		Practical Marks		Total Marks
L	T	P	C	ESE	PA	ESE	PA	150
3	0	2	5	70	30*	20	30	

Legends: L -Lecture; **T** -Tutorial/Teacher Guided Student Activity; **P** -Practical; **C** - Credit; **ESE**-End Semester Examination; **PA** -Progressive Assessment.

4. COURSE DETAILS

Unit	Major Learning Outcomes	Topics and Sub-topics
Unit – I **Introduction & Characteristics of IC Engine:**	1.a 2 stroke & 4 stroke. 1.b Timing diagrams of 2 & 4 stroke cycles. 1.c I.C engines & parts	1.1 4-Stroke and 2-stroke cycles; Deviation from Ideal condition in actual engines; Limitation in parameters. 1.2 Timing Diagrams of 2 - Stroke and 4-Stroke engines. Comparative study of slow speed, medium speed and high speed diesel engines - suitability and requirements for various purposes Mean Piston speed. 1.3 M.C.R. & C.S.R. ratings and thermal efficiency. Impulse-reaction and parson's turbine. Degree of reaction, condition for maximum Energy transfer in Reaction turbines. 1.4 Stage efficiency, overall efficiency and reheat factor, condition curve. Gearing and Lubrication System. Stresses acting on marine steam turbine. 1.5 Binary vapor cycle and its effect on Thermal Efficiency, Steam machinery plants, combined steam & gas plant. 1.6 Constructional Details of I.C. Engines: Principal Components: Fuel Injectors, Air Starting Valves, Relief Valves, Hydraulic exhaust valves, Air distributors, Jackets and Liners, Cylinder heads ,Piston, Cross heads, Connecting rods, Bed Plates, A-frames, Welded construction for Bed plates & frames, Tie rods.
Unit – II **Scavenging and Supercharging System**	2.a Scavenging& Types 2.b Supercharging using turbochargers & its importance.	2.1 Scavenging arrangements in 2-Stroke engines; Air charging and exhausting in 4-Stroke engines; 2.2 Various types of Scavenging in 2-stroke engines; Uni-flow, loop, cross loop and reverse loop scavenging, their merits and demerits. 2.3 Scavenge pumps for normally aspirated engines; under piston scavenging, Scavenge manifolds. 2.4 Pulse and constant pressure type; their relative merits and demerits in highly rated marine propulsion engine. 2.5 Air movements inside the cylinders. Turbocharger and its details. Two stage, un-cooled, radial turbochargers.

Unit – III **Combustion & Dissociation**	3.a Fuel & its combustion 3.b Fuel injectors & injection timings. 3.c Various pressures during combustion..	3.1 Definition of Fuel, combustion. Combustion Equation, Analysis of the Products of Combustion, 3.2 Stoichiometric combustion, Actual combustion, Excess Air, Mixture strength. 3.3 Dissociation. Effect of Dissociation on IC-Engines. 3.4 Combustion of Fuels: Grades of suitable fuels, Preparation of fuels for efficient combustions ,fuel atomization, ignition quality, fuel injectors and its details, ignition delay, afterburning 3.5 Compression Pressure Ratio and its effects on Engine. Reasons for variation in compression pressure and peak pressure. Design aspects of combustion chamber. Control of NOX and SOX in Exhaust emission.
Unit – IV **Fuels & Lubricants**	4.a Grades of fuels and properties. 4.b Testing for various parameters.	4.1 Composition, properties and characteristics of different fuels and lubricants, additives used, flash point & viscosity as applicable to petrol, kerosene, marine diesel oil, boiler fuel oil, lube oil. 4.2 Sampling and testing procedure, storage and transfer of fuel and lubricants. 4.3 Contamination of fuel and lubricants including microbes.
Unit – V **Medium speed Engines & Compressors**	5a. Medium speed engine & details. 5b. Combustion process. 5c. Consequences & improvements. 5d. Centrifugal compressors	5.1 Different types of medium speed marine diesel engines, couplings, and reduction gear used in conjunction with medium speed Engine, Development in exhaust valve design, V-type engine details. 5.2 Use of poor quality residual fuels and their consequences. 5.3 Improvements in designs for higher power output. 5.4 Fuels, combustion process – fundamentals. 5.5 Principle of centrifugal compression and pressure rise in centrifugal compressor, change in Angular Momentum. Pre-whirl and pre-whirl vanes. 5.6 Mach number at inlet to a centrifugal compressor, slip and slip factor, multi-stage centrifugal compressor.

5. SUGGESTED SPECIFICATIONTABLE WITH HOURS & MARKS(THEORY)

Unit	Unit Title	Teaching Hours	Distribution of Theory Marks			
			R Level	U Level	A Level	Total Marks
I	**Introduction & Characteristics of IC Engine:**	10	05	08	03	16
II	**Scavenging and Supercharging System**	10	05	08	03	16
III	**Combustion & Dissociation**:	06	04	04	02	10
IV	**Fuels and lubricants**	06	04	04	02	10
V	**Medium speed Engines & Compressors**	10	04	06	08	18
Total		**42**	**22**	**30**	**18**	**70**

Legends: R = Remember; U = Understand; A = Apply and above levels (Bloom's revised taxonomy)

Notes:

1. This specification table shall be treated as a general guideline for students and Teachers. The actual distribution of marks in the question paper may slightly vary from above Table.
2. If mid sem test is part of continuous evaluation, unit numbers I, II and unit III up to 3.1 are to be considered.
3. Ask the questions from each topic as per marks weightage. Numerical questions are to be asked only if it is specified. Optional questions must be asked from the same topic.

6. SUGGESTED LIST OF PRACTICAL/EXCERCISES

LIST OF EXPERIMENTS

1. Procedure for dismantling Main Bearings i.e Engine bearings, Cross Head bearings & Bottom end bearings. Check its clearance.
2. Carry out Crankcase inspection.
3. Do valve grinding using Grinding Paste.
4. Removing & Renewing cylinder head ,cylinder liner, Fuel pump.& injectors.
5. Removal of Piston rings.
6. Procedure for dismantling & assembling Diesel engine unit including all cylinder head mountings.
7. Crankshaft deflection, measurements & its tabulation.

8. Overhauling of Turbocharger ,dry washing & wet washing.
9. Checking tie rods & pre tensioning.
10. Overhauling of Heat exchangers & replacing glands packing.
11. Carry out overhauling of centrifugal compressor.

7. SUGGESTED LIST OF STUDENT ACTIVITIES

Perform the tasks mentioned in above Practical/Exercise.

8. SPECIAL INSTRUCTIONAL STRATEGIES (If Any)

Sr. No.	Unit Title	Strategies
1	**Introduction & Characteristics of IC Engine:**	Real life examples. Demonstration of real systems. Movies/Animations. Numerical.
2	**Scavenging and Supercharging System**	
3	**Combustion & Dissociation**	
4	**Fuels and lubricants**	
5	**Medium speed Engines & Compressors**	

9. SUGGESTED LEARNING RESOURCES

(A) Text Book:

1. "Marine Diesel Engine" by Deven Arhana.

(B) Reference Book :

1. Wood yard, Goug, "Pounder's Marine Diesel Engines". 8th Edition, Butter Worth Heinemann Publishing, London 2001
2. D K Sanyal, "Principle'& Practice of Marine Diesel Engines", 2d Edition, Bhandarkar Publication, Mumbai, 1998.
3. "Lamb's Marine diesel Engine".

10. COURSE CURRICULUM DEVELOPMENT COMMITTEE

FACULTY MEMBERS FROM POLYTECHNIC

- **Prof Nair Gopikrishnan**
  (Lecturer in Marine engineering Govt Polytechnic Diu)
- **Prof Devanshu Trivedi**
  (Lecturer in Marine engineering Govt Polytechnic Diu)

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