4334 - INTRODUCTION TO THERMODYNAMICS

Teaching Schedule Per Week			Progressive Assessment		Examination Schedule (Marks)			
					Theory		Practical Ex.	Total
Lectures	Practical	Credits						
3	1	4	25	25	3 Hrs	100	-	150

Pre-requisite	Source
Nil	SHB

Semester	Theory	Test	Total	TW	PR	Gr Total
14	75	25	100	25	–	125

Rationale: A general survey carried out to determine the competencies required by a diploma in Shipbuilding Engineering student revealed that the student should have an elementary knowledge of Thermodynamics. The knowledge that he acquires in this subject becomes the pre-requisites for Marine Engineering courses. In view of this emphasis has been laid on topics like gas processes, IC Engines, properties of steam, heat transfer and introduction to refrigeration. This subject thus provides the required cognitive skills to the student to take further courses in Marine Engineering.

OURSE CONTENTS	Hrs	Mks
1. BASIC CONCEPTS OF THERMODYNAMICS	8	15

Introduction, working substance or medium, system, state and properties of a substance process and cycle. System of units, units of pressure, units of volume, units of temperature, units of work & power, units of energy. Laws of thermodynamics, Zeroth law of thermodynamics, first law of thermodynamics, second law of thermodynamics. Specific heat, perfect gas laws, characteristic equation for a perfect gas.

2. GAS PROCESSES		
Thermodynamic processes of gases, constant volume process, constant pressure process, constant temperature process, adiabatic process, reversible adiabatic (Isotropic) process, polytropic process, throttling process. Processes on P-V diagram and T-ϕ diagram. Calculations of work done and heat transferred.	7	
3. AIR STANDARD CYCLES	5	1
Cycles of operation- Otto cycle, Diesel cycle, Dual cycle, Brayton cycle. Air standard efficiencies of above cycles.		
4. INTERNAL COMBUSTION ENGINES	8	1
Introduction: Classification of IC engines, engine parts and terms, introduction to different systems of IC engine, four stroke cycle engine operation, two stroke cycle engine operation, comparison of two stroke cycle engines and four stroke cycle engine, indicated power and brake power calculations, mechanical efficiency and brake thermal efficiency calculations.		
5. PROPERTIES OF STEAM	10	2
Introduction. Conservation of form, phase diagram, effect of pressure on boiling point of water, temperature pressure curves for steam, formation of steam at constant pressure. Condition of steam, wet steam, saturated steam, dry saturated steam, superheated steam, dryness fraction of saturated steam, use of steam tables, sensible heat, latent heat of vaporisation, Enthalpy of-Wet steam, dry saturated steam, superheated steam. Specific volume of steam, internal energy of steam, application of steam in engines and turbines, use of PV diagrams conversion of pressure energy to kinetic energy.		
6. ELEMENTS OF HEAT TRANSFER	4	1
Basic concepts of heat transfer, conduction of heat transfer, Fourier law of heat, convective heat transfer, radiation heat transfer, introduction to heat exchangers (only elementary details), parallel flow heat exchanger, counter flow heat exchanger.		
7. REFRIGERATION CYCLES	6	1
Reversed heat engine cycle, vapour compression refrigeration cycle, performance and capacity of vapour compression plant, actual vapour in a vapour compression plant, components in a vapour compression plant, gas cycle refrigeration, refrigerants and application of refrigeration.		
Total	48	10

PRACTICALS

Study of different parts of IC engines	(2 turns)
Experiment on heat transfer.	(2 turns)
Experiment on 4 – stroke diesel engine, calculation of indicated power, brake power and mechanical efficiency	(2 turns)
Study of vapour compression refrigeration system.	(2 turns)
Determination of C.O.P. of vapour compression refrigeration system	(2 turns)
Study of steam calorimeter.	(2 turns)
Use of steam tables.	(2 turns)

REFERENCE BOOKS

1. Thermal Engineering by P. L. Ballaney
2. Engineering Thermodynamics by P. K. Naag.
3. Elements of heat engines Vol. I by Patel and Karamchandani.
4. Heat engines by Pandya Shah
5. Heat and Mass transfer by Domkundwar
6. Refrigeration and Air-conditioning by C. P. Arora