GUJARAT TECHNOLOGICAL UNIVERSITY, AHMEDABAD, GUJARAT
Course Curriculum
Marine Thermodynamics
(Code: 3341802)

Diploma Programme in which this course is offered	Semester in which offered
Marine Engineering	4th Semester

1. RATIONALE

The marine engineer working in the engine room of the ship need to have a basic knowledge of thermodynamics. He should know about the theoretical cycles, steam and its properties. The engineer should know about the basic principle of working of engines. The engineer in watch keeping duty should have knowledge about thermodynamics to maintain the machineries in the engine room.

2. COMPETENCY

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

- Understand about the two phase system.
- Study of steam and its properties.
- Know about the working of boiler, mountings and accessories
- Study about turbine, condenser, cooling towers.
- Acquire broader ideas about basic principles of refrigeration and air conditioning.

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.

* 30 marks of Theory PA include two assignments each of 5 marks. First assignment must have total 12 numerical from Unit number I,II and III. Second assignment must be of 10 numerical from Unit number IV and V and report on student activities performed. Each numerical of each assignment must have different parameters for each student, that is each student will get total 22 numerical with same problem but with varied parameters. (Values of temperature, pressure, volume, etc may be different for each student.).

4. COURSE DETAILS

Unit	Major Learning Outcomes	Topics and Sub-topics
Unit – I **Two phase system**	1.a Describe steam formation process and terminology.. 1.b Use steam table and Mollier chart for determination of steam property. 1.c Determine dryness fraction of steam. 1.d Explain throttling process.	1.1 Concept of two phase system. 1.2 Formation of steam, its various phases, definition and representation of wet steam, dry steam, saturated steam and superheated steam on PV, T-s and H-s diagram. 1.3 Concept and determination of dryness fraction and degree of superheat. 1.4 Concept and determination of latent heat, sensible heat, enthalpy, entropy and specific volume of steam.. 1.5 Use of Steam tables and Mollier chart- (Heat Entropy Chart). 1.6 Numerical examples based on above.(1.1 to 1.5). 1.7 Throttling process. 1.8 Methods of measurement of steam quality, Calorimeters- Bucket, Separating, Throttling and Combined calorimeters. (No numerical Problems).
Unit – II **Boilers, mountings and accessories**	2.a Introduction to Boilers. 2.b Types,Acessories & Mountings of Boiler. 2.c Starting and safety of boilers.	2.1 Steam boiler-concept, definition as per Indian Boilers Regulation (IBR), functions, features and classification. Functions, features, Safety valve-water level indicator-fusible plug-pressure gauge-steam stop valve – Blow off cock – man holes. 2.2 Working, merits and demerits of following low pressure & High pressure steam boilers. i. Simple vertical boiler. ii. Lancashire boiler. iii. Cochran boiler. iv. Babcock and Wilcox water tube boiler. v. Waste heat recovery boiler. vi. Water Tube boiler(high pressure boiler) vii. Superheated steam boiler(high pressure boiler) 2.3 Starting of boiler in cold condition-safety precautions-Provisions in Indian boiler act regarding safety. 2.4 Boiler mountings and

		accessories functions, working and location on boilers. 2.4 Boiler draught system-concept and classification.
Unit – III **Turbine and** **condenser**	3.a Introduction and different cycles. 3.b Types of turbines and comparison 3.c Condensers, types and working.	3.1 Introduction - steam power cycles. 3.2 Impulse turbine –reaction turbine – comparison of impulse and reaction turbine – pressure. 3.3 Compounding of steam turbine: i. Need. ii. Pressure compounding. iii. Velocity compounding. iv. Pressure velocity compounding. 3.4 Condenser – introduction – elements of condensing plant – classification of condenser – surface condenser(down flow, central flow, evaporative condenser) – merits and demerits of surface condenser – condenser Vacuum – condenser efficiency – Dalton's Law. 3.5 Heat exchangers :Plate type& Shell Type.
Unit – IV **Refrigeration** **and Air** **conditioning**	4a.Introduction to Refrigeration &refrigerants used. 4b.Introduction of air conditioning systems 4c. Parameters in air conditioning systems 4d.Various heating and cooling process.	4.1 Refrigerator - Introduction –- classification – performance of refrigerator common refrigerant – ammonia sulphur dioxide – carbon di oxide refrigerants of Freon. 4.2 Effect of change in operating conditions (condenser pressure, evaporator pressure, sub cooling, superheating) on performance of VCRS & its representation on P-h diagram. Application of VCRS: Ice Plant, cold storage, water cooler, domestic refrigerator, deep freezer-block diagram, components, working 4.2 Air conditioning – Introduction – psychometric properties – dry air – moist air – dry bulb temperature – wet bulb temperature – dew point temperature - dew point depression 4.3 Humidity relative humidity – psychometric chart – sensible heating process – sensible cooling process – comfort air conditioning – industrial air conditioning –window air

		conditioning – central air conditioning system – loads encountered in air conditioning system.

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	Two phase system	12	06	07	08	20
III	Boilers	10	04	06	06	16
IV	Turbine and condenser	10	04	07	05	16
V	Refrigeration and Air conditioning	10	06	06	08	18
Total		**42**	**20**	**26**	**27**	**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 3.4 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/EXERCISES

SR. NO	UNIT	PRACTICAL EXERCISE	Hrs Required
1	1	**Demonstration:** (Video/ Movie/Cut Sections /Models may be used in absence of Required Machine/ Equipment/ Device.): a. Steam boilers. b. Boiler mountings and accessories.	04
2	2	**Boiler Performance:** Boiler trial- determination of boiler efficiency, equivalent evaporation and Heat balance sheet. (Based on in-house performance or from the data collected during industrial visit.).	04
3	3	**Demonstration:** (Video/ Movie/Cut Sections /Models may be used in absence of Required Machine/ Equipment/ Device.) a. Steam prime movers-impulse and reaction turbines. b. Working of nozzles c. Types condensers & its cleaning d. Heat Echangers (plate type& shell type)	04
4	4	**Demonstration:** (Video/ Movie/Cut Sections /Models may be used in absence of Required Machine/ Equipment/ Device.)	04

		a. Study of refrigeration cycle &refrigerant used . b. Understanding air conditioning system in any nearby industry. c. Visit cold storage plant, ice plant and airconditioning plant to observe VCRS, different kinds of ducting**.**	
5	**All**	**Mini Project And Presentation**: (In the group of 3-5students- to be assigned in the beginning of the term). a. Identify any one equipment/device/plant (which are included in syllabus) at nearby industry or shipping campus. Sketch the setup, write the specifications, and describe the working of that with process parameters and state applications of that. b. Downloaded photos/ videos, PPTs. Make one CD/DVD for a batch of students. Also prepare a chart or model on given topic. Prepare the seminar. Topics related to syllabus are to be given by teacher. Advancement in the topics areas may also be given. c. Present the seminar at least for 10 minutes for a and b above.This must include photographs movies of group working on project.	**08**
TOTAL			**24**

7. SUGGESTED LIST OF STUDENT ACTIVITIES

S.NO	ACTIVITY
1	Collect/ download product catalogues with specification of various types of energy conservation equipment/ devices and heat exchanger of recent

	trends.
2	At least one visit of any Shipping industry or campus where various items like boiler, air compressor, heat exchanger, , condenser etc. can be shown to students.
3	Identify and list at least 10 equipment's/devices which require heat transfer and prevention of heat transfer. Also state mode of heat transfer and methods used to prevent heat transfer

8. SPECIAL INSTRUCTIONAL STRATEGIES (If Any)

Sr. No.	Unit	Unit Title	Strategies
1	I	Two phase system	Real life examples. Demonstration of real systems. Movies/Animations. Numerical, Charts& Industrial Visit.
2	II	Boilers	
3	III	Turbine and condenser	
4	IV	Refrigeration and Air conditioning	

9. SUGGESTED LEARNING RESOURCES

(A) List of Books:

Text Book : Thermal Engg, P.L.Ballaney

Thermal Engg, R.S. Khurumi

Reference Book : Thermal Engg, Raj Putt

10. COURSE CURRICULUM DEVELOPMENT COMMITTEE.

FACULTY MEMBERS FROM POLYTECHNIC

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

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