GUJARAT TECHNOLOGICAL UNIVERSITY

Subject Name: MARINE ELECTRO TECHNOLOGY
(Code: 3351803)

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

1. RATIONALE

Diploma holders in marine engineering should have enough knowledge about electrical operated machines . A marine engineer must be capable of trouble shooting any electrical errors occurring onboard. As well as to read the circuit diagrams onboard to find out and rectify the errors.

2. COMPETENCY

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

- Understand about 3 phase induction motor & starters.
- Know about how paralleling of generators is done and why it is done & excitation methods.
- Study about Alternators and its operations.
- Understand about emergency generators its requirements and its starting procedures.

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 **3Ø Induction motor**	1.a Principle of 3Ø system. 1.b Explain how a rotational field is produced in a 3 phase induction motor. 1.c Differentiate between squirrel cage and wound rotor induction motor with their salient features. 1.d Explain various methods of speed control of 3 phase induction motor. 1.e State the maintenance procedure of both squirrel cage and wound rotor induction motor 1.f Induction motor working. 1.g Types of starters.	1.1 Principle of operation and theory of action, slip speed, rotor to stator relationship, rotor frequency, rotor e.m.f. and current. 1.2 Construction, types - Squirrel cage - Single and double cage, Wound rotor 1.3 Equivalent circuit relationship between rotor IR loss and the rotor slip, torque/slip characteristics, starting torque and maximum running torque, reversing, speed control of induction motor. 1.4 Starting of induction motor, method of starting D.O.L, Star/Delta, Auto, Testing of motor, Single and three phase induction motor principle and operational characteristics, starting control constructional details. 1.5 Maintenance of different types of induction motors
Unit – II **Alternators-General**	2.a Explain the working principle of an alternator. 2.b Construction of alternators 2.c Stator windings & types. 2.d Synchronize an alternator with infinite bus bar. 2.e State the maintenance requirements of the alternators including the different cooling systems of the alternators	2.1 Arrangement of alternators, construction of salient pole and cylindrical- rotor types. 2.2 Types of stator windings, single and double layer windings, e.m.f equation of an alternator, distribution and pitch factor, waveform of generated e.m.f., alternator on load, percentage regulation, internal voltage drop, production of rotating magnetic field, 2.3 Resultant magnetic field distribution, mathematical , reversal of direction of rotation of rotating field. 2.4 Synchronization of alternator with bus bar/alternator. 2.5 Cooling system of alternator. 2.6 Maintenance of different types of alternators

Unit – III **Armature reaction in synchronous alternator**	3.a Paralleling of alternators. 3.b Excitation in generators. 3.c Differentiate the features between the synchronous and induction motor. 3.d State the maintenance requirements of the synchronous motor	3.1 Armature reactance, prediction of voltage regulation, open circuit test, short circuit test, Synchronous impedance ,torque/angle characteristics, infinite bus bar, synchronizing current, torque and power, hunting of phase swinging, parallel operation of alternators, 3.2 A.c. generators in parallel-excitation control, throttle control, load sharing KW and KVA, principle of action of three phase synchronous motor effect of varying load and excitation, methods of starting 3.3 Advantages and disadvantages of synchronous motor. 3.4 Maintenance of synchronous motors
Unit – IV **Power Generation Equipment & Automatic Voltage Regulation:**	4.a Electrical & electronic symbols. 4.b Parallelin-g of alternators & Flow charts. 4.c Automatic voltage regulator	4.1 Overview of marine electrical systems the basic components / systems and the conditions under which they have to function 4.2 Electrical and Electronic Symbols and Interpretation of flow Diagram and circuits. Mandatory requirements for electrical installations 4.3 Electrical control system of Prime Mover. Construction of brushless high speed alternators. 4.4 Automatic Voltage Regulators, rapid voltage response of alternators. Paralleling of alternators.
Unit – V **Alternative Source of Power & Distribution**	5.a Emergency generators& starting methods. 5.b Electrical distribution. E.S.B & M.S.B	5.1 Emergency Generator & Different starting method including auto -start, emergency batteries and its different types & duties, Location of emergency power. 5.2 Different Emergency loads, Rules & Regulation of emergency power, Maintenance of Emergency power source on board. Shore Supply - Specifications as per Voltage /frequency ,Precautions while taking shore supply. 5.3 Different electrical diagrams and their uses, electrical signals. Type of Distribution, Distribution network on board. 5.4 Main & emergency switch board, construction, different switch gear & protective devices, Grounded and Insulated neutral systems.

5. SUGGESTED SPECIFICATION TABLE WITH HOURS & MARKS(THEORY)

Unit	Unit Title	Teaching Hours	Distribution of Theory Marks			
			R Level	U Level	A Level	Total Marks
I	Three phase induction motor	06	04	03	03	10
II	Alternators-general	06	04	03	03	10
III	Armature reaction in synchronous alternator	10	04	06	06	16
IV	Power Generation Equipment & Automatic Voltage Regulation.	10	04	06	05	16
V	Alternative Source of Power & Distribution.	10	04	08	06	18
Total		**42**	**20**	**26**	**23**	**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

LIST OF EXPERIMENTS :

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- Study electrical circuit diagrams of important systems in totality
- Perform No Load and Blocked Rotor Test on single phase induction motor to determine the equivalent circuit parameter of given induction motor.
- Obtain the Slip-Torque characteristics and efficiency curve of 3 phase Induction Motor from circle diagram
- To find performance of 3 phase Induction Motor on No Load condition
- To determine the voltage regulation of an Alternator by Synchronous Impedance method
- To obtain load characteristics of an Alternator by performing Direct Load Test & Determine Voltage regulation.
- To Obtain 'V' curve of a synchronous Motor at No Load
- To Study the parallel operation & synchronizing of Alternator
- To study the different Methods of starting of induction motor
- Study the speed control method of induction Motor.

7. SUGGESTED LIST OF STUDENT ACTIVITIES

- Carry out the practicals as mentioned in the above exercises.

8. SPECIAL INSTRUCTIONAL STRATEGIES (If Any)

Sr. No.	Unit	Unit Title	Strategies
1	I	Three phase induction motor	Real life examples. Demonstration of real systems. Movies/Animations. Numerical.
2	II	Alternators-general	
3	III	Armature reaction in synchronous alternator	
4	IV	Power Generation Equipment & Automatic Voltage Regulation.	
5	V	Alternative Source of Power & Distribution.	

9. SUGGESTED LEARNING RESOURCES

List of Books:

(A) Text Book:

A Text Book of Electrical Technology Vol 2 -B L Thareja & A K Thareja.

(B) Reference Books :

Electrical Technology - Hughes Edward
Electric Machine - Ashfaq Husain.

10. COURSE CURRICULUM DEVELOPMENT COMMITTEE

FACULTY MEMBERS FROM POLYTECHNIC

- **Prof Ashvin M Bamaniya**
  (Head of Department Electrical Engineering Govt Polytechnic Diu)
- **Prof Nair Gopikrishnan**
  (Lecturer in Marine engineering Govt Polytechnic Diu)
- **Prof Devanshu Trivedi**
  (Lecturer in Marine engineering Govt Polytechnic Diu)

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