



**BIJU PATTANAİK INSTITUTE OF TECHNOLOGY**  
**GOVERNMENT POLYTECHNIC, PURI**  
ସରକାରୀ ବହୁବୃତ୍ତି ଅନୁଷ୍ଠାନ, ପୁରୀ

# **LESSON PLAN**

**ON**

**ENERGY CONVERSION-II**

**5<sup>TH</sup> SEMESTER**

***PREPARED BY***

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**GOVERNMENT POLYTECHNIC,  
PURIDEPARTMENT OF ELECTRICAL ENGINEERING**

Discipline: <b>ELECTRICAL ENGG</b>	Semester: <b>5<sup>TH</sup></b>	Name of the Teaching Faculty: <b>MRAUROBINDO GHOSE,</b> <b>LECTURER IN ELECTRICAL ENGG.</b>	
Subject: <b>ENERGY CONVERSION-II</b>	No. of days/ per week class allotted : <b>04</b>	Semester-5 <sup>th</sup> No. of Weeks: <b>15</b>	From date: <u>15/09/2022</u> To Date: <u>22/12/2022</u>
<b>PRE-REQUISITE</b>	Basic knowledge about network solving and engineering mathematics.		
<b>COURSE OUTCOMES</b>	<b>CO1:</b> Understand the working principles of synchronous machine, 3 phase and 1 phase motors <b>CO2:</b> Understand their operating principle and working characteristics, torque equation of three phase motors <b>CO3:</b> Understand the losses and efficiency of all machines <b>CO4:</b> To develop problem solving ability on synchronous machines and 3-phase induction motor for better understanding about the concept of machines <b>CO5:</b> To be familiar with starting and speed control of AC motors		
<b>Week</b>	<b>Class Day</b>	<b>Theory/Practical Topics</b>	<b>DELIVERY METHOD</b>
<b>1<sup>ST</sup></b>	<b>1<sup>ST</sup></b>	Types of alternator and their constructional features	Whiteboard
	<b>2<sup>ND</sup></b>	Basic working principle of alternator and the relation between speed and frequency	Whiteboard
	<b>3<sup>RD</sup></b>	Terminology in armature winding and expressions for winding factors (Pitch factor, Distribution factor)	Whiteboard
	<b>4<sup>TH</sup></b>	Explain harmonics, its causes and impact on winding factor, E.M.F equation of alternator.	Whiteboard
<b>2<sup>ND</sup></b>	<b>1<sup>ST</sup></b>	Problem Solving	Whiteboard
	<b>2<sup>ND</sup></b>	Explain Armature reaction and its effect on emf at different power factor of load	Whiteboard
	<b>3<sup>RD</sup></b>	The vector diagram of loaded alternator	Whiteboard
	<b>4<sup>TH</sup></b>	Problem solving	Whiteboard
<b>3<sup>RD</sup></b>	<b>1<sup>ST</sup></b>	Testing of alternator (Short circuit test and Open circuit test)	Whiteboard
	<b>2<sup>ND</sup></b>	Determination of voltage regulation of Alternator by direct loading and synchronous impedance method	Whiteboard
	<b>3<sup>RD</sup></b>	Parallel operation of alternator using synchro-scope and dark & bright lamp method	Whiteboard
	<b>4<sup>TH</sup></b>	Explain distribution of load by parallel connected alternators	Whiteboard
<b>4<sup>TH</sup></b>	<b>1<sup>ST</sup></b>	<b>QUIZ &amp; ASSIGNMENT-I</b>	Lecture notes
	<b>2<sup>ND</sup></b>	Constructional feature of Synchronous Motor	Whiteboard
	<b>3<sup>RD</sup></b>	Principles of operation, concept of load angle	Whiteboard
	<b>4<sup>TH</sup></b>	Derive torque, power developed	Whiteboard
<b>5<sup>TH</sup></b>	<b>1<sup>ST</sup></b>	Problem solving	Whiteboard
	<b>2<sup>ND</sup></b>	Effect of varying load with constant excitation	Whiteboard
	<b>3<sup>RD</sup></b>	Effect of varying excitation with constant load	Whiteboard
	<b>4<sup>TH</sup></b>	Power angle characteristics of cylindrical rotor motor	Whiteboard
<b>6<sup>TH</sup></b>	<b>1<sup>ST</sup></b>	Explain effect of excitation on Armature current and power factor	Whiteboard
	<b>2<sup>ND</sup></b>	Hunting in Synchronous Motor, Function of Damper Bars in synchronous motor and generator	Whiteboard
	<b>3<sup>RD</sup></b>	Describe method of starting of Synchronous motor	Whiteboard



		State application of synchronous motor	
	4 <sup>TH</sup>	<b>QUIZ&amp;ASSIGNMENT-II</b>	Lecture notes
7 <sup>TH</sup>	1 <sup>ST</sup>	Production of rotating magnetic field, Constructional feature of Squirrel cage and Slip ring induction motors	Whiteboard
	2 <sup>ND</sup>	Working principles of operation of 3-phase Induction motor, Define slip speed, slip and establish the relation of slip with rotor quantities.	Whiteboard
	3 <sup>RD</sup>	Derive expression for torque during starting and running conditions and derive conditions for maximum torque.	Whiteboard
	4 <sup>TH</sup>	Torque-slip characteristics	Whiteboard
8 <sup>TH</sup>	1 <sup>ST</sup>	Problemsolving	Whiteboard
	2 <sup>ND</sup>	Derive relation between full load torque and starting torque etc.	Whiteboard
	3 <sup>RD</sup>	Establish the relations between Rotor Copper loss, Rotor output and Gross Torque and relationship of slip with rotor copper loss	Whiteboard
	4 <sup>TH</sup>	Methods of starting and different types of starters used for three phase Induction motor	Whiteboard
9 <sup>TH</sup>	1 <sup>ST</sup>	Explain speed control by Voltage Control, Rotor resistance control, Pole changing, frequency control methods	Whiteboard
	2 <sup>ND</sup>	Plugging as applicable to three phase induction motor Describe different types of motor enclosures	Whiteboard
	3 <sup>RD</sup>	Explain principle of Induction Generator and state its applications	Whiteboard
	4 <sup>TH</sup>	<b>QUIZ &amp; ASSIGNMENT-III</b>	Lecture notes
10 <sup>TH</sup>	1 <sup>ST</sup>	Explain Ferrari's principle. Explain double revolving field theory and Cross-field theory to analyze starting torque of 1-phase induction motor	Whiteboard
	2 <sup>ND</sup>	Split phase motor	Whiteboard
	3 <sup>RD</sup>	Capacitor Start motor	Whiteboard
	4 <sup>TH</sup>	Capacitor start, capacitor run motor	Whiteboard
11 <sup>TH</sup>	1 <sup>ST</sup>	Permanent capacitor type motor	Whiteboard
	2 <sup>ND</sup>	Shaded pole motor	Whiteboard
	3 <sup>RD</sup>	<b>QUIZ &amp; ASSIGNMENT-IV</b>	Lecture notes
	4 <sup>TH</sup>	Construction, working principle, running characteristic and application of single-phase series motor	Whiteboard
12 <sup>TH</sup>	1 <sup>ST</sup>	Construction, working principle and application of Universal motors	Whiteboard
	2 <sup>ND</sup>	Working principle of Repulsion start Motor, Repulsion start Induction run motor, Repulsion Induction motor	Whiteboard
	3 <sup>RD</sup>	Principle of Stepper motor, Classification of Stepper motor	Whiteboard
	4 <sup>TH</sup>	Principle of variable reluctance stepper motor Principle of Permanent magnet stepper motor	Whiteboard
13 <sup>TH</sup>	1 <sup>ST</sup>	Principle of hybrid stepper motor Applications of Stepper motor	Whiteboard
	2 <sup>ND</sup>	Explain Grouping of winding, Advantages	Whiteboard
	3 <sup>RD</sup>	Explain parallel operation of the three phase transformers	Whiteboard
	4 <sup>TH</sup>	Explain tap changer (On/Off load tap changing)	Whiteboard
14 <sup>TH</sup>	1 <sup>ST</sup>	Maintenance Schedule of Power Transformers	Whiteboard
	2 <sup>ND</sup>	<b>QUIZ &amp; ASSIGNMENT-V</b>	Lecture notes
	3 <sup>RD</sup>	REVISION	
	4 <sup>TH</sup>	REVISION	
	1 <sup>ST</sup>	REVISION	

15TH	2ND	REVISION	
	3RD	REVISION	
	4TH	REVISION	

### LEARNING RESOURCES:

01. Electrical Technology-II, B.L. Theraja and A.K. Theraja SChand Publisher
02. Electrical Technology, J. B. Gupta, S.K. Kataria and Sons
03. Electric Machine, Ashfaq Husain, Dhanpat Rai and Sons
04. Electrical Machines, D P Kothari, I J Nagrath, Mc Graw Hill

### WEBSITE RESOURCES:

01. [https://www.youtube.com/watch?v=G8pM3CkWm5M&list=RDCMUCgp23vdLNaUitOkCxxVnRrg&start\\_radio=1&rv=G8pM3CkWm5M](https://www.youtube.com/watch?v=G8pM3CkWm5M&list=RDCMUCgp23vdLNaUitOkCxxVnRrg&start_radio=1&rv=G8pM3CkWm5M) (NPTEL)
02. <https://www.youtube.com/playlist?list=PLp6ek2hDcoNCANsWM2mw3qi0387BhfLyV> (NPTEL)

Sign. of Faculty concerned

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