

# LESSON PLAN

**DEPARTMENT OF ELECTRICAL ENGINEERING, ITT, CHOUDWAR**

**SUBJECT: ENERGY CONVERSION-II**      **Periods: 4 per week**      **SEMESTER: 5<sup>TH</sup>**

**NAME OF FACULTY: Satyajit Pani**      **No. of weeks: 15**

| Week            | Period          | Theory / Practical Topics   |
|-----------------|-----------------|---|
| 1st             | 1 <sup>st</sup> | <b>ALTERNATOR</b><br>Types of alternator and their constructional features  |
|                 | 2 <sup>nd</sup> | Basic working principle of alternator and the relation between speed and frequency.   |
|                 | 3 <sup>rd</sup> | Terminology in armature winding and expressions for winding factors (Pitch factor, Distribution factor).                              |
|                 | 4 <sup>th</sup> | Explain harmonics, its causes and impact on winding factor.   |
| 2 <sup>nd</sup> | 1 <sup>st</sup> | E.M.F equation of alternator  |
|                 | 2 <sup>nd</sup> | Numericals on winding factors and E.M.F Equation  |
|                 | 3 <sup>rd</sup> | Explain Armature reaction and its effect on emf at different power factor of load.  |
|                 | 4 <sup>th</sup> | The vector diagram of loaded alternator   |
| 3 <sup>rd</sup> | 1 <sup>st</sup> | Testing of alternator<br>Open circuit test .&. Short circuit test   |
|                 | 2 <sup>nd</sup> | Numericals on vector diagram & tests.   |
|                 | 3 <sup>rd</sup> | Determination of voltage regulation of Alternator by direct loading and synchronous impedance method.                                 |
|                 | 4 <sup>th</sup> | Numericals on regulation.   |
| 4 <sup>th</sup> | 1 <sup>st</sup> | Parallel operation of alternator using synchro-scope and dark & bright lamp method.   |
|                 | 2 <sup>nd</sup> | Explain distribution of load by parallel connected alternators .  |
|                 | 3 <sup>rd</sup> | <b>SYNCHRONOUS MOTOR:</b><br>Constructional feature of Synchronous Motor.<br>Principles of operation, concept of load angle           |
|                 | 4 <sup>th</sup> | Derive torque, power developed  |
| 5 <sup>th</sup> | 1 <sup>st</sup> | Effect of varying load with constant excitation   |
|                 | 2 <sup>nd</sup> | Effect of varying excitation with constant load   |
|                 | 3 <sup>rd</sup> | Power angle characteristics of cylindrical rotor motor.   |
|                 | 4 <sup>th</sup> | Explain effect of excitation on Armature current and power factor   |
| 6 <sup>th</sup> | 1 <sup>st</sup> | Hunting in Synchronous Motor.<br>Function of Damper Bars in synchronous motor and gen.  |
|                 | 2 <sup>nd</sup> | Describe method of starting of Synchronous motor  |
|                 | 3 <sup>rd</sup> | State application of synchronous motor  |
|                 | 4 <sup>th</sup> | <b>THREE PHASE INDUCTION MOTOR:</b><br>Production of rotating magnetic field.   |
| 7 <sup>th</sup> | 1 <sup>st</sup> | Constructional feature of Squirrel cage and Slip ring induction motors.<br>Working principles of operation of 3-phase Induction motor |
|                 | 2 <sup>nd</sup> | Define slip speed, slip and establish the relation of slip with rotor quantities.   |
|                 | 3 <sup>rd</sup> | Derive expression for torque during starting and running conditions and derive conditions for maximum torque.                         |
|                 | 4 <sup>th</sup> | Numerical on torque   |
| 8 <sup>th</sup> | 1 <sup>st</sup> | Torque-slip characteristics. Derive relation between full load torque and starting torque etc.  |
|                 | 2 <sup>nd</sup> | Numerical on torque relationship.   |

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|                  | 3 <sup>rd</sup> | Establish the relations between Rotor Copper loss, Rotor output and Gross Torque and relationship of slip with rotor copper loss. |
|                  | 4 <sup>th</sup> | Numericals on power stages.   |
| 9 <sup>th</sup>  | 1 <sup>st</sup> | Methods of starting and different types of starters used for three phase Induction motor  |
|                  | 2 <sup>nd</sup> | Explain speed control by Voltage Control, Rotor resistance control, Pole changing, frequency control methods.                     |
|                  | 3 <sup>rd</sup> | Plugging as applicable to three phase induction motor.  |
|                  | 4 <sup>th</sup> | Describe different types of motor enclosures.<br>Explain principle of Induction Generator and state its applications              |
| 10 <sup>th</sup> | 1 <sup>st</sup> | <b>SINGLE PHASE INDUCTION MOTOR:</b><br>Explain Ferrari's principle   |
|                  | 2 <sup>nd</sup> | Explain double revolving field theory and Cross-field theory to analyze starting torque of 1-phase induction motor .              |
|                  | 3 <sup>rd</sup> | Split phase motor.  |
|                  | 4 <sup>th</sup> | Capacitor Start motor   |
| 11 <sup>th</sup> | 1 <sup>st</sup> | Capacitor start, capacitor run motor.   |
|                  | 2 <sup>nd</sup> | Permanent capacitor type motor  |
|                  | 3 <sup>rd</sup> | Shaded pole motor.  |
|                  | 4 <sup>th</sup> | Explain the method to change the direction of rotation of above motors  |
| 12 <sup>th</sup> | 1 <sup>st</sup> | <b>COMMUTATOR MOTORS:</b><br>Construction, working principle  |
|                  | 2 <sup>nd</sup> | Running characteristic and application of single phase series motor.  |
|                  | 3 <sup>rd</sup> | Construction, working principle and application of Universal motors   |
|                  | 4 <sup>th</sup> | Working principle of Repulsion start Motor .  |
| 13 <sup>th</sup> | 1 <sup>st</sup> | Working principle of Repulsion start Induction run motor,   |
|                  | 2 <sup>nd</sup> | Working principle of Repulsion Induction motor  |
|                  | 3 <sup>rd</sup> | <b>SPECIAL ELECTRICAL MACHINE:</b><br>Principle of Stepper motor.<br>Classification of Stepper motor                              |
|                  | 4 <sup>th</sup> | Principle of variable reluctant stepper motor   |
| 14 <sup>th</sup> | 1 <sup>st</sup> | Principle of Permanent magnet stepper motor   |
|                  | 2 <sup>nd</sup> | Principle of hybrid stepper motor.  |
|                  | 3 <sup>rd</sup> | Applications of Stepper motor   |
|                  | 4 <sup>th</sup> | <b>THREE PHASE TRANSFORMERS:</b><br>Explain Grouping of winding, Advantages.  |
| 15 <sup>th</sup> | 1 <sup>st</sup> | . Explain parallel operation of the three phase transformers  |
|                  | 2 <sup>nd</sup> | Explain tap changer (On/Off load tap changing)  |
|                  | 3 <sup>rd</sup> | Explain tap changer (On/Off load tap changing)  |
|                  | 4 <sup>th</sup> | Maintenance Schedule of Power Transformers  |

Teaching Faculty