

**Course Name: UTILISATION OF ELECTRIC POWER**

**Course Code: EE- 702**

**Credit: 4**

**Prerequisites:**

Sl. No.	Subject	Description	Level of Study
01	Basic knowledge on Electric Machine,	DC Series Motor, Induction Motor	2 <sup>nd</sup> sem
02	Basic concepts of different laws on Electrostatic and Electromagnetism	Faraday's Law, Fleming's Rule	Class XII, 1stSem

**Course Objective:**

- To understand the basic principles of light control and types of light schemes.
- To impart how to design the traction system considering economic and technology up-gradation.

**Course Outcomes:**

*At the end of the course, a student will be able to:*

1. **Illustrate** working principle electric power utilization and their application in real life.
2. **Choose** proper traction systems depending upon application considering economic and technology up-gradation.
3. **Employ** mathematical and graphical analysis considering different practical issues to **design** of traction system; analyze the performance parameter of the traction system.
4. **Examine** various applications in indoor and outdoor application areas where use of light sources are essential.
5. **Classify** types of electric light sources based on nature of operation and their objectives, performance and reliability.

6. **Select** most suitable type and specification of illumination source for efficient conversion and **Recognize** different process of utilizing electric energy for heating and electrolytic process in industries purposes mostly in commercial along with few house hold applications.

**CO- PO mapping:**

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
<b>1</b>	3	3	3	1	2	2	2	1	2	2	1	1
<b>2</b>	3	3	3	3	2	1	2	2	1	2	2	2
<b>3</b>	3	2	3	2	2	3	2	1	2	2	1	1
<b>4</b>	2	2	3	3	1	2	2	2	1	1	2	2
<b>5</b>	2	2	3	3	2	2	2	2	1	3	2	2
<b>6</b>	3	2	3	2	1	2	2	3	1	1	2	2

**Correlation levels 1, 2 or 3 as defined above: 1: Slight (Low) 2: Moderate (Medium)3: Substantial (High) and “-” if there is no correlation.**

**Syllabus Indicating CO:**

Module No.	Content	Relevant CO's
<b>1</b>	<p><b>ELCTRIC TRACTION:</b>Requirement of an ideal traction system, Supply system for electric traction, Train movement( speed time curve, simplified speed time curve, average speed and schedule speed).</p> <p>Mechanism of train movement (energy consumption, tractive effort during acceleration,tractive effort on a gradient, tractive effort for resistance, power &amp; energy output for the driving axles, factors affecting specific energy consumption,coefficient of adhesion).</p>	<b>CO2,CO3</b>

	<p><b>Electric traction motor &amp; their control:</b></p> <p>Parallel and series operation of Series and Shunt motor with equal and unequal wheel diameter, effect of sudden change of in supply voltage, Temporary interruption of supply. Tractive effort and horse power.</p> <p>Use of AC series motor and Induction motor for traction.</p> <p><b>Traction motor control:</b> DC series motor control, Multiple unit control, Braking of electric motors, Electrolysis by current through earth, current collection in traction system, Power electronic controllers in traction system.</p>	
2	<p><b>ILLUMINATION:</b></p> <p>The nature of radiation, Polar curve, Law of illumination, Photometry (Photovoltaic cell, distribution photometry, integrating sphere, brightness measurement).</p> <p><b>Types of Lamps:</b> Conventional and energy efficient, Basic principle of light control, Different lighting scheme &amp; their design methods, Flood and Street lighting.</p>	CO1,CO4,CO5
3	<p><b>ELECTRIC HEATING AND WELDING:</b></p> <p>Types of heating, Resistance heating, Induction heating, Arc furnace, Dielectric heating, Microwave heating.</p>	CO6
4	<p><b>ELECTROLYTIC PROCESSES:</b></p> <p>Basic principles, Faraday's law of Electrolysis, Electro deposition, Extraction and refining of metals, Power supply of Electrolytic processes.</p>	CO6

## Gaps in Syllabus:

SL No.	Gap	Action Taken	Relevant to PO's
1	<p><b>Electric Traction:</b> The action of pulling something over a surface especially on road or track involving the use of electricity.</p> <p><b>Topics covered:</b> Mechanical features of electric drive, Load equalization, flywheel calculations, examples.</p>	Additional lecture classes were organized providing notes, and by solving numerical problems.	<p><b>PO 3, PO 5,</b></p> <p><b>PO 8</b></p>
2	<p><b>Tractive Effort:</b> The effective force necessary to propel the train at the wheels of the locomotive.</p> <p><b>Topics covered:</b> Factors affecting energy consumption, dead weight, accelerating weight, adhesion weight, examples.</p>	Additional <b>lecture classes</b> are organized to cover the topics.	<p><b>PO 2,</b></p> <p><b>PO 4</b></p>
3	<p><b>Application of Drive:</b> A wheel or other part in a mechanism that receives power directly and transmits motion to other parts.</p> <p><b>Topics covered:</b> election of drive for applications such as general workshop, textile mill, paper mill, steel mill, printing press, crane, lift etc.</p>	These are emergent topics under application of drives, hence additional classes were taken and notes were provided.	<b>PO 3, PO 5</b>
4	<p><b>Arc welding and Heating:</b> It is a type of welding that uses a welding power supply to create an electric arc between an electrode and the base material to melt the metals at the welding point.</p> <p><b>Topics covered:</b> Design of heating element.</p>	Extra class was arranged in a workshop and notes provided and assignment given	<b>PO 2</b>
5	<p><b>Illumination and Lighting:</b></p> <p>Lighting or illumination is the deliberate use of light to achieve a practical or aesthetic effect.</p> <p><b>Topics covered:</b> Factory Lighting</p>	Assignment was given	<b>PO 4, PO3</b>
6	<p><b>Electrolytic processes:</b> An electrolytic process is the use of electrolysis industrially to refine metals or compounds at a high purity and low cost.</p> <p><b>Topics Covered:</b> Rating of metals, production of chemicals.</p>	Additional <b>lecture classes</b> are organized to cover the topics	<p><b>PO 3, PO 5</b></p> <p><b>PO 7</b></p>

**Lecture Plan:**

<b>Sl No</b>	<b>Date</b>	<b>Topics</b>	<b>Remarks</b>
1-4		Requirement of an ideal traction system, Supply system for electric traction, Train movement ( speed time curve, simplified speed time curve, average speed and schedule speed)	Problems to be solved
5-7		Mechanism of train movement (energy consumption, tractive effort during acceleration, tractive effort on a gradient, tractive effort for resistance, power & energy output for the driving axles, factors affecting specific energy consumption, coefficient of adhesion)	Problems to be solved
8-12		Parallel and series operation of Series and Shunt motor with equal and unequal wheel diameter, effect of sudden change of in supply voltage, Temporary interruption of supply, Tractive effort and horse power	
13		Use of AC series motor and Induction motor for traction	
14-15		DC series motor control, Multiple unit control, Braking of electric motors	Problems to be solved
16-17		Electrolysis by current through earth, current collection in traction system, Power electronic controllers in traction system.	
18-19		The nature of radiation, Polar curve, Law of illumination	
20		Photometry (Photovoltaic cell, distribution photometry, integrating sphere, brightness measurement)	
21-23		Types of Lamps: Conventional and energy efficient, Basic principle of light control, Different lighting scheme & their design methods, Flood and Street lighting.	
24-26		Types of heating, Resistance heating, Induction heating	
27-28		Arc furnace, Dielectric heating, Microwave heating	Problems to be solved

29-30		Basic principles, Faraday's law of Electrolysis	Problems to be solved
31-34		Electro deposition, Extraction and refining of metals, Power supply of Electrolytic processes.	

**Recommended Books:**

1. Elements of Electromagnetic, Mathew N.O. Sadiku, 4th edition, Oxford University Press.
2. Electromagnetic field theory fundamentals, Guru & Hizroglu, 2nd edition, Cambridge University Press..
3. Electromagnetic with application, Krause, 5th Edition, TMH.