

## 403150 Elective – IV: Introduction to Electrical Transportation Systems

### Teaching Scheme

Lectures: 4 Hrs./Week

### Examination Scheme

Theory: 100 Marks

#### Unit I General Review of Transportation

Need and importance of mobility, various modes of transportation, evolution of transportation system, Horse carriages to steam engines to internal combustion engines to electric vehicles, advantages and disadvantages of electric mobility, various application of electric mobility such as electrical traction, hybrid electric and electric vehicles, elevators, personal mobility and special applications such as wheel chairs, future concepts.

(8 hours)

#### Unit II EV- Basic Building Blocks

Various sources of energy used in transportation and their characteristics, Conventional vehicle power transmission systems. Energy conversions module integrations and their operation. Different types of Batteries & their operation. Types of batteries, their characteristics, charging and discharging of batteries, round trip efficiency, ability to deliver instantaneous power, load cycle and its effect on battery performance, environmental impact of batteries, power quality issues related to charging of batteries. Different load characteristics (Specifically road characteristics)

(8 hours)

#### Unit III Power module & Energy convertors

Need for power converters, basic power electronic blocks, AC/DC, DC/DC, DC/AC modules. Types of mechanical drives, conversion of electrical energy into mechanical energy, characteristics of various types of drives, BLDC machines, AC machines, DC machines, mechanical drive / power train

(6 hours)

#### Unit IV Control system and instrumentation

Function of instrumentation and control system, speed control, acceleration characteristics, mechanical steering versus electric steering, motion control, driverless vehicles, road safety and traffic control and monitoring, emerging trends

(6 hours)

#### Unit VI

##### Electric cars

Emerging trend, typical power train architecture, hybrid cars, acceleration and speed characteristics,

##### Traction

Introduction to Modern AC traction for high speed rail application, their control and performance under different operating conditions. Comparison of AC/DC traction.

(8 hours)

#### Unit VI Elevators

Load characteristics of elevator systems, Introduction to control schemes in elevators with new power-electronics controlled drives, considerations for energy efficient systems. Special vehicles, basic concepts and emerging trends.

(8 hours)

#### Text Books:

1) Electrical Vehicle Explained by James Larminie and John Lowry, John Wiley & Sons, 2012.

2) The Electric Vehicle Conversion handbook –Mark Warner, HP Books, 2011.

- 3) Electric & Hybrid Vehicles-Design Fundamentals, CRC press
- 4) R& Dell RM Batteries for Electric Vehicles, Rand D.A.J, Woods

**Reference Books :**

- 1)Modern Electrical Hybrid Electric and Fuel Cell Vehicles:Fundamental,Theory and design by Mehrdad Ehsani ,Yimin Gao and Ali Emadi. CRC Press, 2009.
- 2)Electric Traction for railway trains by Burch Edward, McGraw Hill, 1911.
- 3)Modern Electric Traction by H.Partab –Dhanpat Rai & Sons, 1973.
- 4)Elevators Technology by George C.Barney, Published for the international Association of Elevator Engineers by Ellis Harwood, John Wiley & Sons, 1986.