

FUNDAMENTALS OF ELECTRIC VEHICLE TECHNOLOGY	
Subject Code: MEOE09	Credits: 3:0:0
Pre requisites: Nil	Contact Hours: 42L
Course Coordinator: Mr. Nishanth R A	

Course Content

Unit I:

Review of conventional IC engine vehicle –limitations and environmental impact, Introduction to Electric vehicles, Need for electric vehicles, Basic working principle of plug-in EV.

- Pedagogy/course delivery tools: Chalk and talk, Power Point Presentation
- Links: https://www.youtube.com/watch?v=_uhDDs5xyoY

Unit II:

Hybrid Electric vehicles – Classification, Layout and Architecture – Series, Parallel and Series Parallel Hybrid, Power train systems, Regenerative Braking.

- Pedagogy/course delivery tools: Chalk and talk, Power Point Presentation
- Links: <https://www.youtube.com/watch?v=47U1g4ChVkM>

Unit III:

Electric vehicle power train- brief outline of electric motor, battery pack, inverter, charger and converter, Electric Motors- AC/DC Motors/ Generators, Brushed DC Motor/ Brushless DC Motor - Torque Characteristics, torque vectoring, switched reluctance motors, induction motors, axial flux motors, Basics of EV suspension system.

- Pedagogy/course delivery tools: Chalk and talk, Power Point Presentation
- Links: <https://circuitdigest.com/article/different-types-of-motors-used-in-electric-vehiclesev>

Unit IV:

Batteries-Types, Lithium-ion battery, Sodium ion battery, Battery management system (BMS): Introduction, Illustration of BMS, battery pack capacity and range, Battery state evaluation: State of charge (SOC), State of health (SOH), State of Life (SOL), Battery Modelling, Challenges encountered in BMS and the possible solutions, Battery recycling: need, market, methods, advantages in current context.

- Pedagogy/course delivery tools: Chalk and talk, Power Point Presentation
- Links: <https://www.cyient.com/blog/battery-management-system-in-electric-vehicles>

Unit V:

EV charging –methods of charging: conductive, inductive and battery swapping, AC charging, DC charging. Fuel cell vehicles – Introduction, Types of fuel cells, Operating principles, Advantages and Drawbacks of fuel cells.

- Pedagogy/course delivery tools: Chalk and talk, Power Point Presentation
- Links: <https://www.ag-elec.com/understand-various-charging-methods-of-electric-vehicles.html>

Text books:

- 1) James Larminie, John Lowry, *Electric Vehicle Technology Explained*, John Wiley & Sons Ltd, 2nd ed., 2012
- 2) K. T. Chau - *Electric Vehicle Machines and Drives Design, Analysis and Application*- WileyIEEE Press (2015)
- 3) G A Goodarzi, John G Hayes - *Electric powertrain _ energy systems, power electronics & drives for hybrid, electric & fuel cell vehicles* (2018, John Wiley & Sons)
- 4) Christopher D. Rahn, Chao Yang Wang - *Battery Systems Engineering*, 2013 edition, John Wiley and Sons Ltd.

Reference books:

- 1) C.C. Chan and K.T. Chau, *Modern Electric Vehicle Technology*, Oxford University Press, 2001.
Ali Emadi, *Handbook of Automotive Power Electronics and Motor Drives*, CRC Press Taylor & Francis Group, 2005
- 2) Iqbal Hussein, *Electric and Hybrid Vehicles: Design Fundamentals*, CRC Press Taylor & Francis Group, 2003.

Course outcomes

1. Understand the development of EV technology over the years and also its suitability in different areas of transportation. [PO1, PO3, PO6, PO12 & PSO1]
2. Learn the important components in an EV and hybrid vehicles [PO1, PO9& PSO1]
3. Identify and categorize the different parts and systems necessary for smooth and hassle-free operation of EV [PO1, PO3& PSO1]
4. Reflect upon the need to improve the different parameters in battery management system for safe and reliable operation of battery pack [PO1, PO3, PO5, PO6& PSO2]
5. Learn effective charging methods and compare the performance characteristics of Li ion batteries with that of fuel cells [PO1, PO6, PO7 &PO 12]

Course Assessment and Evaluation:

Continuous Internal Evaluation (CIE)- 50 Marks		
Assessment tool	Marks	Course outcomes addressed
Internal test-I	30	CO-1 & CO-2
Internal test-II	30	CO-3, CO-4 & CO-5
Average of the two internal tests will be considered for evaluation of 30 Marks		
Other components- 20 Marks		
Assignment	10	CO-1, CO-2, CO-3
Quiz	10	CO-4 & CO-5
Semester End Examination- 100 Marks		
Semester End Examination (SEE)	100	CO-1, CO-2, CO-3, CO-4 & CO-5

SCIENCE, EDUCATION & TECHNOLOGY FOR RURAL INDIA	
Subject Code: MEOE10	Credits: 3:0:0
Pre requisites: Nil	Contact Hours: 42L
Course Coordinator: Dr. B P Hari Chandra	

Course Preamble:

Thousands of youths who are studying in engineering colleges are from rural background. After engineering they are desperate to find jobs in cities, since the aspects they would study during any engineering course hardly fit in anywhere, even in case they want to go back to their villages. Further, there is a mindset among the larger student community that if they have to have a bright career, it can happen only in cities. However, there are uncountable number of cases to prove that the other way round is also possible. Hence there is a need to show the options on the other side. This elective course is designed to address the issue.

This course educates the engineering students as to how and what sciences, education and technologies could be adopted in villages and make the students confident enough to think about going back to their villages, have a career in their villages; perhaps a healthier and challenging career than the ones in cities. Thus, the students not only start a career on their own, but also to give employment opportunities to a couple of village youths. This would go a long way in rural development; and urban development too by avoiding overcrowding and mass migration into cities.

SYLLABUS

Unit I

Introduction: Current status of villages in India, village swaraj, basic principles of self sustainable villages, role and potentials of rural economy in the new economic era, Vision of sustainable rural development.

Water management: Water management and water harvesting techniques for villages. Grey water harvesting. Successful case studies of water management.

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| † Pedagogy/Course delivery tools: | ☐ Chalk and talk, power point presentation |
| | ☐ Subject videos |
| † Video | ☐ https://www.youtube.com/live/u2pvevYr0Y8 |

Unit II

Sustainable agriculture: Status of Indian agriculture in the past. Sustainable agriculture: principles and strategies, successful case studies. Soil and its fertility management, soil carbon and biochar. Introduction to *Vrukshayurveda*, *Krushi Parashara* and Agro Homeopathy. Career through growing medicinal plants. Cow based economy. permaculture

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| † Pedagogy/Course delivery tools: | ☐ Chalk and talk, power point presentation |
| | ☐ Subject videos |

✚ Video □ <https://www.youtube.com/live/u2pvevYr0Y8>

✚ Journal □ Relevance of Ayurveda for organic cultivation of medicinal plants, article
Ashwini et. al., Journal of Ayurveda & Integrated medical sciences, Vol.7, No.1, 2022

□ <https://drive.google.com/file/d/1vgRvFTCZDKvf3MUblpARgrBET7DrmQuZ/view?usp=sharing>

Unit III

Power projects: Strategies for utilization of rural biomass. Modules for harnessing biogas. Commercial models of mini power generation, solar power generation and rural needs. Biofuels production. Commercial equipment's.

Education: Scope and options for vocational training, aspects of rural entrepreneurship and career options for engineers.

✚ Pedagogy/Course delivery □ Chalk and talk, power point presentation
tools: □ Subject videos

Unit IV

Agricultural machinery and processing: The labour problem, need for tiny agricultural machinery, commonly used simple agricultural machinery and implements, micro dairy, processes of value addition for agricultural produce. Tiny technologies for the rural masses.

Role of computers and IoT in rural development.

✚ Pedagogy/Course □ Chalk and talk, power point presentation delivery tools: □
Subject videos

Khadi & Village Industries: Motivation from history. Varieties and produces of KVI in India. Scope and importance of khadi and khadi products. Scope for application of current technologies for KVI. Tiny looms.

✚ Pedagogy/Course delivery □ Chalk and talk, power point presentation
tools: □ Subject videos

Unit V

Model villages: Study of selected role models of villages; viz., solar village, clean village etc.

Need for application of modern technologies in rural areas - brainstorming. **Conceptual mini project:** Conceptual mini project on sustainable village model, power, machinery, processing for value addition of agricultural produce. (A student or a group of 2-3 shall come out with any one of these concepts). The same shall be presented as seminar to the peers. Application of AI

✚ Pedagogy/Course delivery □ Chalk and talk, power point presentation
tools: □ Subject videos
□ Learning through discussions on the
Presentations by students on conceptual
models developed.

Text books:

- Village swaraj, M K Gandhi, Navjivan Trust, 2015
- Secrets of fertile soil, Erhard Hennig, Acres, USA, 2015
- Bhageeratha, War on water crisis: Converting dry land into wet land, Ayyappa Masagi, Water Literacy Foundation, 2016
- The Philosophy of Spiritual Farming (Part 1), Subhash Palekar, Subhash Palekar Publications, Amaravati, Maharashtra, 2016
- The Principles of Spiritual Farming (Part 2), Subhash Palekar Publications, Amaravati, Maharashtra, 2016
- SEAT for Rural India, B P Hari Chandra 2021
- Faculty Notes

Journals/Reference:

- Journal of Rural Technology
- Indian Journal of Rural Technology
- Kurukshetra
- Any other journals of relevance

Course objectives:

To teach the students to:

- CO1: Have an understanding the overall past and present status, typical problems and needs of, and availabilities for rural areas especially the water management
- CO2: Understanding the typical problems and the sustainable solutions thereon of yield, soil and in general, the typical aspects of agriculture.
- CO3: understand the aspects pertaining to power production from local resources and vocational training required for the rural masses.
- CO4: Understand machinery and options for value addition of agricultural produce and other technologies to promote rural employment
- CO5: Providing and understanding of the success of model villages and attempt to create conceptual models for more villages

[illegible]

Course outcomes:**At the end of the course students:**

- CO1: Will have an understanding the overall past and present status, typical problems and needs of, and availabilities for rural areas especially the water management (PO1, PO6, PO7 PO12)
- CO2: Would have understood the typical problems and the sustainable solutions thereon of yield, soil and in general, the typical aspects of agriculture. (PO2, PO6, PO7)
- CO3: will have an understanding of the aspects pertaining to power production from local resources and vocational training required for the rural masses. (PO1, PO6, PO7)
- CO4: would have understood typical machinery and options for value addition of agricultural produce and other technologies to promote rural employment (PO6, PO7)
- CO5: will have an idea and understanding regarding the successful model villages and would be able to attempt to create conceptual models for more villages (PO1, PO11, PO12)

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