INSTITUTEOFAERONAUTICALENGINEERING

(Autonomous)
Dundigal, Hyderabad-500043

ELECTRICAL AND ELECTRONICS ENGINEERING

TUTORIAL QUESTION BANK

Course Title	**HYBRID ELECTRIC VEHICLES**				
Course Code	AEE019				
Programmer	B. Tech				
Semester	VIII	EEE			
Course Type	CORE				
Regulation	**IARE - R16**				
Course Structure	**Theory**			**Practical**	
	Lectures	**Tutorials**	**Credits**	**Laboratory**	**Credits**
	3	1	4	0	0
Chief Coordinator	Mrs.P. Sindhu, Assistant Professor				
Course Faculty	Mrs.P. Sindhu Assistant Professor.				

COURSE OBJECTIVES:

The course should enable the students to:	
I	Interpret the social and environmental importance of hybrid and electrical vehicles
II	Discuss the concept of hybrid traction and electric traction with the help of hybrid drive train and electric drive train topologies.
III	Explain the electric propulsion unit of hybrid electric vehicles.
IV	Understand the configuration and control of different types of electric drives.
V	Demonstrate the concepts of energy storage and energy management in hybrid electric vehicles.

COURSE OUTCOMES (COs):

CO 1	Impacts of Conventional Vehicles on the Society and Different Types of Drive Train Topologies.
CO 2	Load Modelling based on the Road Profile and Braking Systems used in Hybrid Electric Vehicles.
CO 3	Different Types of Motors used in Electric Vehicles and Hybrid Electric Vehicles.
CO 4	Different Types of Energy Storage Systems Used in Hybrid Electric Vehicles.
CO 5	The Concept of Energy Management Strategies Used in Hybrid Electric Vehicles.

COURSE LEARNING OUTCOMES (CLOs):

AEE019.01	Explain the social and environmental importance of hybrid and electric vehicles.
AEE019.02	Describe the performance of hybrid and electric vehicles.
AEE019.03	Discuss the basic concepts of hybrid traction, introduction to various hybrid drive-train topologies.
AEE019.04	Discuss the basic concepts of electric traction.
AEE019.05	Explain power flow control in hybrid and electric drive train topologies.
AEE019.06	Analyze the fuel efficiency of hybrid and electric drives.
AEE019.07	Examine the configuration and control of DC motor drives.
AEE019.08	Illustrate the configuration and control of induction motor drives.
AEE019.09	Classify the configuration and control of permanent magnet motor drives.
AEE019.10	Explain the configuration and control of switched reluctance motor drives.
AEE019.11	Discuss the energy storage requirements in hybrid and electric vehicles.
AEE019.12	Analyze the various energy storage systems based on battery and fuel cell based on battery and fuel cell.
AEE019.13	Analyze the various energy storage systems based on super capacitor and flywheel.
AEE019.14	Explain the hybridization of various energy storage devices, its advantages and challenges.
AEE019.15	Classify different energy management strategies used in hybrid and electric vehicles.
AEE019.16	Discuss the implementation issues of energy management strategies
AEE019.17	Understand the impact of the professional engineering solutions in societal and environmental contexts.
AEE019.18	Explore the knowledge and skills of employability to succeed in national and international level competitive examinations.

TUTORIAL QUESTION BANK

UNIT- I				
INTRODUCTION OF HYBRID ELECTRIC VEHICLES				
Part - A (Short Answer Questions)				
S No	**QUESTIONS**	**Blooms Taxonomy Level**	**Course Outcomes**	**Course Learning Outcomes (CLOs)**
1	What is the definition of Hybrid?	Remember	CO 1	AEE019.01
2	What is the definition of Hybrid Electric vehicles?	Remember	CO 1	AEE019.01
3	Classify Hybrid Electric vehicles?	Remember	CO 1	AEE019.01
4	What is the definition of Conventional vehicles?	Remember	CO 1	AEE019.01
5	Classify Hybrid Electric vehicles?	Remember	CO 1	AEE019.01
6	Describe the Advantages of Hybrid Electric Vehicles?	Understand	CO 1	AEE019.02
7	Describe the Disadvantages of Conventional Vehicles?	Understand	CO 1	AEE019.02
8	What is an exactly Hybrid Electric Vehicles?	Understand	CO 1	AEE019.01
9	What is conventional Vehicles?	Understand	CO 1	AEE019.01
10	What are the Environmental impacts of Hybrid Electric Vehicles?	Understand	CO 1	AEE019.01
11	Define Regenerative Braking of Hybrid Electric Vehicles?	Remember	CO 1	AEE019.03
12	Draw the Transmission Characteristics of Vehicles?	Creating	CO 1	AEE019.03
13	What are the Electrical losses in Hybrid Electrical Vehicles?	Remember	CO 1	AEE019.01
14	What are commonly used motors in Electric Vehicles?	Understand	CO 1	AEE019.01
15	What are the Minimum parts of Hybrid Drive Trains?	Remember	CO 1	AEE019.01
16	What are the factors of Vehicle Performances?	Remember	CO 1	AEE019.01
17	What are the Social impacts of Hybrid Electric Vehicles?	Understand	CO 1	AEE019.01
18	Distinguish between Hybrid Electric vehicles and conventional vehicles?	Remember	CO 1	AEE019.02
19	Classify Conventional Vehicles?	Understand	CO 1	AEE019.02
20	What are the causes of Global Warming?			
Part - B (Long Answer Questions)				
1	What are the social impacts of Hybrid Electric Vehicles?	Understand	CO 1	AEE019.01
2	What are the Environmental impacts of Hybrid Electric Vehicles?	Understand	CO 1	AEE019.01
3	Explain the History of Hybrid Electric Vehicles?	Remember	CO 1	AEE019.01
4	Explain the Drawbacks of Conventional Vehicles?	Understand	CO 1	AEE019.02
5	Distinguish between Hybrid Electric Vehicles and Conventional Vehicles?	Analyzing	CO 1	AEE019.02
6	Explain the Impact of modern Drive Trains on Energy Supplies?	Understand	CO 1	AEE019.02
7	Explain the overview of Hybrid Electric Vehicles?	Understand	CO 1	AEE019.01
8	Explain the Overview of Conventional Vehicles?	Understand	CO 1	AEE019.01
9	Explain about the basics of Vehicle performances?	Understand	CO 1	AEE019.01
10	Explain about the Vehicle power Source Characterization?	Understand	CO 1	AEE019.02
11	Describe the Transmission Characteristics of Conventional Vehicles?	Understand	CO 1	AEE019.02
12	Describe the Mathematical model Vehicle performance?	Understand	CO 1	AEE019.02
13	What are the Comparisons of Hybrid Electric Vehicles and Conventional Vehicles?	Understand	CO 1	AEE019.02
14	Explain the Benefits of Hybrid Electric vehicles?	Understand	CO 1	AEE019.02
15	Explain the overview of Hybrid Electric Vehicles?	Understand	CO 1	AEE019.01
16	Explain the occurrence of the Global Warming due to Conventional Vehicles?	Understand	CO 1	AEE019.01
17	Explain the History of Hybrid Electric Vehicles?	Understand	CO 1	AEE019.02
18	Explain the History of Fuel Cell Vehicles?	Understand	CO 1	AEE019.01
19	What are the Comparisons of Hybrid Electric Vehicles and Conventional Vehicles?	Understand	CO 1	AEE019.02
20	Write about the one of the environmental impacts of Nitrogen Oxides?	Understand	CO 1	AEE019.01
Part - C (Problem Solving and Critical Thinking Questions)				
1	Describe the Mathematical model Vehicle performance?	Understand	CO 1	AEE019.02
2	Explain about the Vehicle power Source Characterization?	Understand	CO 1	AEE019.02
3	Describe the Transmission Characteristics of Conventional Vehicles?	Understand	CO 1	AEE019.02
4	Explain about the induced cost of conventional Vehicles:	Analyzing	CO 1	AEE019.01

5	Explain about the Importance of Different Transportation Development Strategies to Future Oil Supply	Analyzing	CO 1	AEE019.01
6	Explain about petroleum resources of conventional Vehicles?	Understand	CO 1	AEE019.01
7	Describe the Mathematical model Vehicle performance?	Analyzing	CO 1	AEE019.01
8	Write about the one of the environmental unburned Hydro Carbons?	Understand	CO 1	AEE019.01
9	Explain about social impacts of Conventional Vehicles?	Understand	CO 1	AEE019.01
10	Explain the occurrence of the Global Warming due to Conventional Vehicles?	Understand	CO 1	AEE019.01
	UNIT-II			
	HYBRID ELECTRIC DRIVE TRAINS			
	Part – A (Short Answer Questions)			
1	Define Traction?	Remember	CO 2	AEE019.04
2	What is Hybrid Electric Drive Train?	Understand	CO 2	AEE019.03
3	What is Electric Drive Train?	Understand	CO 2	AEE019.03
4	Define Hybrid Traction?	Remember	CO 2	AEE019.04
5	Define Electric Traction?	Remember	CO 2	AEE019.03
6	Classify Hybrid Electric Drive Trains?	Understand	CO 2	AEE019.02
7	Classify Electric Drive Trains?	Remember	CO 2	AEE019.02
8	What is Hybrid Traction?	Understand	CO 2	AEE019.03
9	List out the Main parts of Series Hybrid Electric Drive Trains?	Remember	CO 2	AEE019.03
10	List out the Main parts of Series Hybrid Electric Drive Trains?	Remember	CO 2	AEE019.03
11	Write the Advantages of Hybrid Electric Drive Trains?	Remember	CO 2	AEE019.03
12	Write the Advantages of Series Hybrid Configuration of Hybrid Electric Drive Train?	Remember	CO 2	AEE019.03
13	Write the Advantages of Series Hybrid Configuration of Electric Drive Train?	Understand	CO 2	AEE019.03
14	Write the Advantages of Parallel Hybrid Configuration of Hybrid Electric Drive Train?	Understand	CO 2	AEE019.03
15	Write the Advantages of Parallel Hybrid Configuration of Electric Drive Train?	Understand	CO 2	AEE019.03
16	List out the power control strategies of Hybrid Electric drive Train?	Remember	CO 2	AEE019.05
17	List out the power control strategies of Electric drive Train?	Remember	CO 2	AEE019.05
18	Draw the diagram of series hybrid Electric Drive Train?	Creating	CO 2	AEE019.03
19	Draw the diagram of Parallel hybrid Electric Drive Train?	Creating	CO 2	AEE019.03
20	Write the Disadvantages of Hybrid Electric Drive Trains?	Understand	CO 2	AEE019.03
	Part - B (Long Answer Questions)			
1	Explain the Configurations of Hybrid Electric Drive Train?	Understand	CO 2	AEE019.03
2	Explain The concept of Hybrid Traction?	Understand	CO 2	AEE019.04
3	Explain the concept of Various Hybrid Drive Train Topologies?	Understand	CO 2	AEE019.03
4	Explain the Series Configurations of Hybrid Drive Train with Neat Diagram?	Understand	CO 2	AEE019.03
5	Explain the Parallel Configurations of Hybrid Drive Train with Neat Diagram?	Understand	CO 2	AEE019.03
6	Explain the Series - Parallel Configurations of Hybrid Drive Train with Neat Diagram?	Understand	CO 2	AEE019.03
7	What are the Benefits of Hybrid Electric Drive Trains?	Understand	CO 2	AEE019.03
8	Explain Fuel Efficiency Analysis of Hybrid Electric Drive Trains?	Understand	CO 2	AEE019.03
9	Explain the Power Flow Analysis of Hybrid Drive Trains?	Understand	CO 2	AEE019.03
10	Explain the Various Electric Drive Train Topologies?	Understand	CO 2	AEE019.03
11	Explain the power flow control strategies in Electrical Drive Train Topologies?	Understand	CO 2	AEE019.03
12	Explain Fuel Efficiency Analysis of Electric Drive Trains?	Understand	CO 2	AEE019.06
13	Explain the Series Configurations of ElectricDrive Train with Neat Diagram?	Understand	CO 2	AEE019.03
14	Distinguish Between Hybrid drive Trains and Electric Drive Train?	Understand	CO 2	AEE019.03
15	Explain the Parallel Configurations of ElectricDrive Train with Neat Diagram?	Understand	CO 2	AEE019.03
16	Explain the Series - Parallel Configurations of Electric Drivetrain with Neat Diagram?	Understand	CO 2	AEE019.03
17	What are the Advantages and Disadvantages of Electric Drive Train?	Understand	CO 2	AEE019.03
18	Explain about Energy consumption in Electric vehicles?	Understand	CO 2	AEE019.03
19	Explain about concept of Hybrid drive Train?	Understand	CO 2	AEE019.03
20	Explain about Speed coupling and torque coupling of Parallel Hybrid train?	Understand	CO 2	AEE019.03
	Part - C (Problem Solving and Critical Thinking Questions)			
1	Explain the configuration of Power Flow Control in Complex Hybrid Control with Neat Diagrams?	Understand	CO 2	AEE019.03
2	Explain about Configuration of Electric vehicles?	Understand	CO 2	AEE019.03

3	Explain About Architecture of Hybrid Electric vehicles?	Understand	CO 2	AEE019.03
4	Explain about Speed coupling of Parallel Hybrid train?	Understand	CO 2	AEE019.03
5	Explain about Torque coupling of Parallel Hybrid train?	Understand	CO 2	AEE019.03
6	Explain about Vehicle performance of Electric Vehicles?	Understand	CO 2	AEE019.03
7	Explain about Tractive Effort in Normal Driving of Electric Vehicles?	Understand	CO 2	AEE019.03
8	Explain the Series - Parallel Configurations of Electric Drivetrain with Neat Diagram?	Understand	CO 2	AEE019.03
9	Explain the Parallel Configurations of ElectricDrive Train with Neat Diagram?	Understand	CO 2	AEE019.03
10	Explain about Traction Motor characteristics in Electric vehicles?	Understand	CO 2	AEE019.03
	UNIT -III			
	ELECTRIC MOTORS FOR HYBRID ELECTRIC VEHICLES			
	Part - A (Short Answer Questions)			
1	What are the Components of Hybrid Electrical Vehicles?	Remember	CO 3	AEE019.07
2	List out the Names of Motors used in Hybrid Electric Vehicles?	Remember	CO 3	AEE019.07
3	Write the Motor principle?	Understand	CO 3	AEE019.07
4	Define Torque? Torque Equation of DC Motor?	Remember	CO 3	AEE019.07
5	Classify the Electric Motor Drives for Electric Vehicles and Hybrid Electric Vehicles?	Remember	CO 3	AEE019.07
6	Write the Induction Motor principle?	Understand	CO 3	AEE019.08
7	What are the Benefits of Induction Motors used in Hybrid Electric Vehicles?	Understand	CO 3	AEE019.08
8	What are the Benefits of Switch Reluctance Motors used in Hybrid Electric Vehicles?	Remember	CO 3	AEE019.10
9	What are The Drawbacks of DC motors used in Hybrid Electric Vehicles?	Understand	CO 3	AEE019.07
10	List out the Control Methods of Induction Motors used in Hybrid Electric Vehicles?	Understand	CO 3	AEE019.07
11	List out the Control Methods of Switch Reluctance Motors used in Hybrid Electric Vehicles?	Understand	CO 3	AEE019.10
12	Define Flux Weakening of motors?	Remember	CO 3	AEE019.07
13	Define Regenerative Mode?	Remember	CO 3	AEE019.08
14	Write the PMMC Motor principle?	Understand	CO 3	AEE019.09
15	Write the Switch Reluctance Motor Principle?	Remember	CO 3	AEE019.10
16	Define voltage Source Inverter	Understand	CO 3	AEE019.07
17	Define Rotor Action?	Understand	CO 3	AEE019.07
18	What is Field Orientation Control?	Understand	CO 3	AEE019.10
19	Define Flux Weakening of motor?	Understand	CO 3	AEE019.07
20	Define Regenerative Mode?	Understand	CO 3	AEE019.07
	Part – B (Long Answer Questions)			
1	Explain the Combined Armature Voltage and Field Control of DC Motors used in Hybrid Electric Vehicles?	Understand	CO 3	AEE019.07
2	Explain the Chopper Control of DC Motors used in Hybrid Electric Vehicles?	Understand	CO 3	AEE019.07
3	Explain the Multi-quadrant Control of DC Motors used in Hybrid Electric Vehicles?	Understand	CO 3	AEE019.07
4	Explain the Constant Volt /Hertz control of Induction motor Drives in Hybrid Electric Vehicles?	Understand	CO 3	AEE019.08
5	Explain the Power Electronics control of Induction motor Drives in Hybrid Electric Vehicles?	Understand	CO 3	AEE019.08
6	Explain about Field Orientation Control of Induction Motor Drives in Hybrid Electric Vehicles?	Understand	CO 3	AEE019.08
7	Describe about Direct Rotor Flux Orientation Schemes of Induction motor Drives used in Hybrid Electric Vehicles?	Understand	CO 3	AEE019.08
8	What are the Advantages and Disadvantages of DC Motors used in Hybrid Electric Vehicles?	Understand	CO 3	AEE019.07
9	What are the Advantages and Disadvantages of Induction Motors used in Hybrid Electric Vehicles?	Understand	CO 3	AEE019.08
10	Explain the Extension of speed Technology of BLDC Motor Drives in Hybrid Electric Vehicles?	Understand	CO 3	AEE019.09
11	Explain the Method of Back EMF sensing Technique of PMMC Motor drives in Hybrid Electric Vehicles?	Understand	CO 3	AEE019.09
12	Explain about Sensor less control methods of Switch Reluctance Motor drives in	Understand	CO 3	AEE019.10

	Hybrid Electric Vehicles?			
13	Explain about the Phase Inductance Based method of Switch Reluctance Motor Drives in Hybrid Electric Vehicles?	Understand	CO 3	AEE019.10
14	What are the Advantages and Disadvantages of PMMC Motors used in Hybrid Electric Vehicles?	Understand	CO 3	AEE019.09
15	What are the Advantages and Disadvantages of Switch Reluctance Motors used in Hybrid Electric Vehicles?	Understand	CO 3	AEE019.10
16	Explain About voltage source inverter for Field Orientation control of Induction motors?	Understand	CO 3	AEE019.10
17	Explain about Steady State performance of Induction motor?	Understand	CO 3	AEE019.10
18	Explain about Two quadrant Chopper Control Forward Motoring and Regenerative Braking of DC Motors?	Understand	CO 3	AEE019.10
19	Explain sensor less techniques of Switch Reluctance motor?	Understand	CO 3	AEE019.10
20	Explain about control methods of PMMC Machine?	Understand	CO 3	AEE019.10
	Part - C (Problem Solving and Critical Thinking Questions)			
1	Explain the Method of Back EMF sensing Technique of PMMC Motor drives in Hybrid Electric Vehicles?	Analyzing	CO 3	AEE019.09
2	Explain the Extension of speed Technology of PMMC Motor Drives in Hybrid Electric Vehicles?	Analyzing	CO 3	AEE019.08
3	Explain about Field Orientation Control of Induction Motor Drives in Hybrid Electric Vehicles?	Analyzing	CO 3	AEE019.08
4	Explain about Properties of PM Materials?	Analyzing	CO 3	AEE019.09
5	Explain about Torque production of a SRM drive?	Analyzing	CO 3	AEE019.09
6	Explain about SRM Drive Converter?	Analyzing	CO 3	AEE019.09
7	Explain sensor less techniques of Switch Reluctance motor?	Analyzing	CO 3	AEE019.09
8	Explain about Sensor less Techniques of PMMC Machine?	Analyzing	CO 3	AEE019.09
9	Explain the Extension of Speed Technology of PMMC machine?	Analyzing	CO 3	AEE019.09
10	Explain the Performance Analysis of PMMC machine?	Analyzing	CO 3	AEE019.09
	UNIT -IV			
	ENERGY STORAGE			
	Part – A (Short Answer Questions)			
1	Define Energy Storages System in Hybrid Electric Vehicles?	Remember	CO 4	AEE019.11
2	What are the Advantages of Battery Energy Storage based System in Hybrid Electric Vehicles?	Remember	CO 4	AEE019.11
3	What is the Principle of Electrochemical Battery?	Remember	CO 4	AEE019.12
4	Write the names of Different Energy Storage Systems of Hybrid Electric Vehicles?	Remember	CO 4	AEE019.11
5	Define Energy Efficiency of Battery?	Understand	CO 4	AEE019.12
6	What are the Disadvantages of Battery Energy Storage System in Hybrid Electric Vehicles?	Remember	CO 4	AEE019.12
7	Write the Features of Super Capacitor?	Understand	CO 4	AEE019.13
8	Define Super Capacitor?	Understand	CO 4	AEE019.13
9	What is the Principle of Super Capacitor?	Understand	CO 4	AEE019.13
10	What are the Advantages of Super Capacitor Energy Storage based System in Hybrid Electric Vehicles?	Understand	CO 4	AEE019.13
11	What are the Advantages of Flywheel Energy Storage System in Hybrid Electric Vehicles?	Remember	CO 4	AEE019.13
12	Define Hybridization storage system?	Understand	CO 4	AEE019.14
13	Classify the Hybridization Storage System?	Understand	CO 4	AEE019.14
14	Define Sizing System in Hybrid Electric Vehicles?	Understand	CO 4	AEE019.14
15	Classify the battery Energy Storage Based System in Hybrid Electric Vehicles?	Remember	CO 4	AEE019.12
16	What is Battery?	Understand	CO 4	AEE019.13
17	Define Lithium battery?	Understand	CO 4	AEE019.13
18	Define Charge Equalization?	Understand	CO 4	AEE019.13
19	Define Flywheel Energy based system?	Understand	CO 4	AEE019.13
20	What is Energy Efficiency of Battery?	Understand	CO 4	AEE019.13
	Part – B (Long Answer Questions)			
1	Explain about the Electrochemical batteries in Energy Storage Based System Of Hybrid Electric Vehicles?	Remember	CO 4	AEE019.11

2	Describe the Different types of battery technologies in Energy Storage Based System Of Hybrid Electric Vehicles?	Understand	CO 4	AEE019.12
3	Explain the Specific power of Battery Based Energy Storage System in Hybrid Electric Vehicles?	Understand	CO 4	AEE019.12
4	Describe the Basic Principle of Super Capacitors based Energy Storage System in Hybrid Electric Vehicles?	Remember	CO 4	AEE019.13
5	Explain the Performance of Super Capacitors in Hybrid Electric Vehicles?	Remember	CO 4	AEE019.13
6	Explain the Super Capacitor Technologies of Hybrid Electric Vehicles?	Understand	CO 4	AEE019.13
7	Explain the Operation and Principle of Flywheel Based Energy Storage System in Hybrid Electric Vehicles?	Understand	CO 4	AEE019.13
8	Explain about Flywheel Technologies of Hybrid Electric Vehicles?	Understand	CO 4	AEE019.1
9	Explain about concept of Hybridization Of Energy Storages in Hybrid Electric Vehicles?	Understand	CO 4	AEE019.14
10	Explain the Sizing System of Electrical machines in Hybrid Electric Vehicles?	Understand	CO 4	AEE019.14
11	Explain the Sizing System of power Electronics in Hybrid Electric Vehicles?	Understand	CO 4	AEE019.14
12	Explain The concept of Parallel Hybridization in Energy Storages of Hybrid Electric Vehicles?	Understand	CO 4	AEE019.14
13	Explain the Power Capacity of Fly Wheel System in Energy Storage System?	Understand	CO 4	AEE019.14
14	Explain About Ultra Capacitor Technologies in Hybrid Electric vehicles?	Understand	CO 4	AEE019.14
15	Explain the Features of Ultracapacitors or super capacitors?	Understand	CO 4	AEE019.14
16	Explain the Features of Switch Reluctance motors?	Understand	CO 4	AEE019.14
17	Explain About Battery Technologies in Energy Storage System?	Understand	CO 4	AEE019.14
18	Explain About Specific power of Energy Storage Systems?	Understand	CO 4	AEE019.14
19	Explain about Performance of Ultra or Supercapacitors?	Understand	CO 4	AEE019.14
20	Explain The concept of Parallel Hybridization in Energy Storages of Hybrid Electric Vehicles?	Understand	CO 4	AEE019.14
	Part – C (Problem Solving and Critical Thinking)			
1	Explain the Techniques to Enhance of Hybrid Performance in Energy Storage based System?	Understand	CO 4	AEE019.14
2	Explain the Concept of Constant power Speed Ratios of Electric Machine Sizing in Energy Storages of Systems?	Understand	CO 4	AEE019.14
3	Explain Mathematical modelling for Lead Acid battery in Energy Storages Systems in Hybrid Electric Vehicles?	Analyzing	CO 4	AEE019.14
4	Explain about Fly Wheel Technologies in Hybrid Electric Vehicles?	Understand	CO 4	AEE019.14
5	Explain about Hybridization System in Energy Storage System?	Understand	CO 4	AEE019.14
6	Explain About Nickel based Batteries in Energy Storage system?	Understand	CO 4	AEE019.14
7	Explain about Lithium Based Batteries in Energy Storage System?	AEE019.14	CO 4	AEE019.14
8	Explain about Energy Efficiency in Energy Storage System?	Understand	CO 4	AEE019.14
9	Explain About Selecting of Energy Storage Technology?	Understand	CO 4	AEE019.14
10	Explain about Fuel cell based Energy Storage Based System?	Understand	CO 4	AEE019.14
	UNIT -V			
	ENERGY MANAGEMENT STRATAGIES			
	Part - A (Short Answer Questions)			
1	Write the Definition of Energy Management Strategies?	Understand	CO 5	AEE019.15
2	Classify Energy Management Strategies?	Remember	CO 5	AEE019.15
3	Define Rule Based Strategy?	Understand	CO 5	AEE019.16
4	Classify Rule Based Strategy?	Remember	CO 5	AEE019.16
5	Classify Optimization Based Strategy?	Remember	CO 5	AEE019.16
6	Write the basic Principle of Rule Based Strategy?	Remember	CO 5	AEE019.16
7	Why Fuzzy logic-based controller used in Hybrid Electric Vehicles?	Understand	CO 5	AEE019.17
8	Define Optimization Strategy?	Understand	CO 5	AEE019.16
9	Define Real Time Optimization Strategy?	Understand	CO 5	AEE019.16
10	Define Battery ECU or management System in Hybrid Electric Vehicles?	Understand	CO 5	AEE019.15
11	What are the Advantages of CAN (control area network) in Energy Management Systems of Hybrid Electric Vehicles?	Remember	CO 5	AEE019.17
12	Classify control variables of Energy Manage Systems in Hybrid Electric Vehicles?	Remember	CO 5	AEE019.17
13	Define Transmission ECU or Energy Management System?	Remember	CO 5	AEE019.17
14	Define Intelligent Control Method?	Remember	CO 5	AEE019.17

15	Define Global Optimization method?	Remember	CO 5	AEE019.17
16	Explain about Real Time Optimization method?	Remember	CO 5	AEE019.17
17	What are the Control Variables in Energy Management system?	Remember	CO 5	AEE019.17
18	Define hybrid ECU?	Remember	CO 5	AEE019.17
19	Define Transmission ECU?	Remember	CO 5	AEE019.17
20	Define power electronic ECU?	Remember	CO 5	AEE019.17
	Part - B (Long Answer Questions)			
1	Explain the Different Categories of Energy Management Strategies in Electric Vehicles and Hybrid Electric Vehicles?	Understand	CO 5	AEE019.15
2	Explain about the Basic Principle of Rule Based Strategy and Deterministic Rule Based Strategies?	Understand	CO 5	AEE019.15
3	How to use FUZZY LOGIC in design of Controllers in Energy Management System in Hybrid Electric Vehicles?	Understand	CO 5	AEE019.17
4	Explain about the Implementation of FUZZY LOGIC of Energy Management System in Hybrid Electric Vehicles?	Understand	CO 5	AEE019.17
5	Explain about the FUZZY Strategies of Energy Management Systems in Hybrid Electric Vehicles?	Understand	CO 5	AEE019.17
6	Classify Energy Management Systems and explain about the Different types of Energy Management Systems?	Understand	CO 5	AEE019.15
7	Explain about the Different types of Energy Management Systems?	Understand	CO 5	AEE019.16
8	Explain about the Elements of Control Theory in both Electric Vehicles and Hybrid Electric Vehicles?	Understand	CO 5	AEE019.17
9	Explain about the Battery Management System in Hybrid Electric Vehicle?	Understand	CO 5	AEE019.18
10	Explain the Comparisons of different Energy Management Systems in Hybrid Electric Vehicles?	Understand	CO 5	AEE019.18
11	Explain about the control functions of Electric vehicles?	Understand	CO 5	AEE019.18
12	Explain About the control functions of Hybrid Electric vehicles?	Understand	CO 5	AEE019.18
13	Explain about the Overview of control theory?	Understand	CO 5	AEE019.17
14	Classify hybrid ECU and explain it Detail?	Understand	CO 5	AEE019.17
15	Explain the basic principle of Rule Based control methods?	Understand	CO 5	AEE019.17
16	Explain about Deterministic Rule Based Strategies in hybrid Electric Vehicles?	Understand	CO 5	AEE019.17
17	Explain about State machine based in Hybrid Electric vehicles?	Understand	CO 5	AEE019.17
18	Explain about Fuzzy Strategy in both hybrid and Electric Vehicles?	Understand	CO 5	AEE019.17
19	Explain about implementation of fuzzy logic in Hybrid Electric Vehicles?	Understand	CO 5	AEE019.17
20	Explain about State machine based in Electric vehicles?	Understand	CO 5	AEE019.17
	Part – C (Problem Solving and Critical Thinking)			
1	Explain about the Modifier Power Follower with Detailed Expressions?	Understand	CO 5	AEE019.18
2	Draw the Block diagram of Control Architecture of Hybrid Electric Vehicles and Analyze the Each part of the Block diagram?	Understand	CO 5	AEE019.17
3	Explain about Global Optimization method?	Understand	CO 5	AEE019.17
4	Explain about Realtime Optimization method?	Understand	CO 5	AEE019.18
5	Explain about the Real time implementations?	Understand	CO 5	AEE019.18
6	Classify Energy Management Systems and explain about the Different types of Energy Management Systems?	Understand	CO 5	AEE019.15
7	Explain Elements of Control Theory?	Understand	CO 5	AEE019.18
8	Explain About Control Area Network (CAN)?	Understand	CO 5	AEE019.17
9	Explain about Deterministic Rule Based Strategies in hybrid Electric Vehicles?	Understand	CO 5	AEE019.17
10	Explain about why Fuzzy logic base is used for Hybrid Electric Vehicles?	Understand	CO 5	AEE019.17

Prepared by:
Mrs. Sindhu, Assistant Professor

HOD, EEE