

UNIT I

**Chapter 1 : Recent Trends in Automobile Industry
1-1 to 1-40**

Syllabus :

- 1.1 Hybrid cars** - Manufactures, Types-Micro Hybrid, Mild Hybrid, Full Hybrid, Series hybrid, Parallel Hybrid
- 1.2 E-vehicles** - Manufacturers, specifications, Types of Batteries, Li-ion batteries, Sodium nickel Chloride Batteries, Sodium Sulphur Batteries, Fuel Cell, Charging - Charging Methods and Modes. Issues with e-vehicles
- 1.3 Safety in Automobile** - Air bags, Automatic Emergency Braking, Adaptive Cruise Control, Electronic stability programmer, Anti Collision system, Active Passive Integration system.

1.1	Hybrid Cars	1-1
1.1.1	Hybrid Car Manufacturers :.....	1-1
1.1.2	Main Parts of Hybrid Vehicle.....	1-2
1.1.3	Classification of Hybrid Cars :	1-3
1.1.4	Plug-in Hybrid Electric Vehicle (PHEV).....	1-4
1.1.5	Hybrid Vehicles and their Specifications :	1-5
1.1.6	Advantages of Hybrid Cars :.....	1-6
1.1.7	Limitations of Hybrid Cars.....	1-6
1.1.8	Functions of Hybrid Cars.....	1-7
1.2	Electric Vehicles	1-7
1.2.1	India's : Electric Vehicle	1-8
1.2.2	E-Vehicles - Government of India Policy.....	1-11
1.2.3	Batteries in Electric Vehicles :.....	1-13
1.2.3.1	Types of Batteries :.....	1-14
1.2.4	Charging in Electric Vehicles	1-17
1.2.4.1	Battery Charging : Methods.....	1-18
1.2.4.2	Battery Charging : Modes.....	1-18
1.2.5	Issues with E-Vehicles.....	1-19
1.3	Safety in Automobiles	1-20
1.3.1	Air Bag	1-21

1.3.2	Automatic Emergency Brake (AEB).....	1-22
1.3.3	Adaptive Cruise Control (ACC).....	1-23
1.3.4	Electronics Stability Programmer (ESP).....	1-24
1.3.4.1	Components of the Electronic Stability Control :	1-25
1.3.5	Anti-Collision system	1-25
1.3.6	Active Passive Integration System.....	1-27
	• Multiple Choice Questions	1-28

UNIT II

Chapter 2 : Process Engineering 2-1 to 2-32

Syllabus :

- 2.1 Process Boilers - Steam and Condensate loop in process industries,
- 2.2 Introduction to ultra-super critical Boilers.
- 2.3 Hyperbolic cooling towers.
- 2.4 Waste heat recovery-process industry.

2.1	Process Boilers	2-1
2.1.1	Various Applications of Process Boilers	2-1
2.1.2	Working of Process Boiler	2-2
2.1.2	Steam and Condensate Loop	2-3
2.2	Introduction to Ultra-super Critical Boilers	2-7
2.2.1	Super Critical boilers	2-7
2.2.2	Ultra Super Critical Boilers.....	2-7
2.2.3	Difference between Supercritical and Ultra Supercritical Boilers	2-8
2.3	Hyperbolic Cooling Tower	2-8
2.3.1	Components of Hyperbolic Cooling Tower	2-9
2.3.2	Types of Hyperbolic Cooling Tower.....	2-9
2.4	Waste Heat Recovery	2-10
2.4.1	Waste Heat Boiler (WHB)	2-10
2.4.2	Waste Heat Recovery Source and Quality.....	2-11
2.4.3	Advantages of Waste Heat Recovery.....	2-11
2.4.4	Waste Heat Recovery Devices.....	2-11
	• Multiple Choice Questions	2-14

UNIT III

**Chapter 3 : Recent Trends in Manufacturing Industry
3-1 to 3-28**

Syllabus :

- 3.1 Smart Manufacturing Technology : introduction, Elements and applications
- 3.2 Automation : Need, Basic elements of automated systems, automation principles and strategies, Benefits. 3.3 Types of Automation : fixed, programmable, flexible, hard and soft automation.
- 3.4 Industrial Robotics : robot anatomy, robot control systems, end effectors, sensors in robotics, industrial Robot applications.
- 3.5 4-D Printing Technology : Printing Techniques, 3D scanning Technology- Function, Applications.

3.1	Smart Manufacturing Technology	3-1
3.1.1	Introduction to Smart Manufacturing	3-1
3.1.2	Revolution of Smart Manufacturing	3-2
3.1.2.1	First Revolution in Industry	3-2
3.1.2.2	Second Revolution in Industry	3-2
3.1.2.3	Third Revolution in Industry	3-3
3.1.2.4	Industry's Fourth Revolution	3-3
3.1.3	Elements of Smart Manufacturing	3-3
3.1.4	Applications of Smart Manufacturing Technology	3-6
3.2	Automation	3-7
3.2.1	Need of Automation	3-7
3.2.2	Basic Elements of Automated System	3-7
3.2.3	Automation Principles and Strategies	3-8
3.2.4	Benefits of Automation	3-9
3.2.5	Demerits of Automation	3-10
3.3	Types of Automation	3-10
3.3.1	Fixed Automation	3-10
3.3.2	Programmable Automation	3-10
3.3.3	Flexible Automation	3-11
3.4	Industrial Robotics	3-12

3.4.1	Robot Anatomy	3-12
3.4.2	Robot Control System	3-12
3.4.3	End Effectors	3-13
3.4.3.1	Types of End Effector	3-13
3.4.4	Sensors in Robotics	3-14
3.4.5	Industrial Robot Applications	3-16
3.5	4-D Printing Technology	3-17
3.5.1	Printing Techniques	3-17
3.5.2	3D Scanning Technology	3-18
3.5.3	Applications of 3D scanning Technology	3-19
	• Multiple Choice Questions	3-21

UNIT IV

Chapter 4 : Energy Audit and Management 4-1 to 4-53

Syllabus :

- 4.1 Standards and labelling standard(HVAC)
- 4.2 Energy Monitoring and Targeting
- 4.3 Energy Management and Audit

4.1	Introduction	4-1
4.1.1	Concept of Energy Audit	4-2
4.1.2	Energy Management	4-2
4.2	Standards and Labelling Standard (HVAC)	4-2
4.2.1	Standards	4-3
4.2.2	Labelling	4-3
4.2.3	Objectives of Standards and Labelling Program	4-3
4.2.4	Reasons for Labelling	4-3
4.2.5	Benefits of Star Labelling	4-3
4.2.6	Types of Labels	4-3
4.2.7	Star labeling/Rating	4-4
4.2.8	Importance of BEE Star Rating Labels	4-5
4.2.9	Details of the BEE Star Ratings	4-5
4.2.10	Star Rating	4-5
4.2.11	Energy Consumption	4-6



4.2.12	Benefits of the Energy Label for Consumers.....	4-6	4.4.14	Reference Year Equivalent Energy Use.....	4-36
4.2.13	Types of Energy Labels.....	4-6	4.4.15	Fuel and Energy Substitution.....	4-37
4.2.14	Guidelines for Understanding Star labels.....	4-7	4.4.15.1	Case Study : Example on Fuel Substitution	4-38
4.2.15	Indian Seasonal Energy Efficiency Ratio (ISEER) ..	4-8		• Multiple Choice Questions	4-42
4.2.16	Savings and Number of Stars.....	4-8			
4.3	Energy Monitoring and Targeting	4-9			
4.3.1	Elements of Monitoring and Targeting System.....	4-11			
4.3.2	Importance of Monitoring and Targeting.....	4-11			
4.3.3	Analysis of Data and Information	4-12			
4.3.4	Pie Chart on Energy Consumption.....	4-13			
4.3.5	Relating Energy Consumption and Production.....	4-13			
4.4	Energy Management and Audit	4-22			
4.4.1	Energy Audit.....	4-22			
4.4.2	Objectives of Energy Audit	4-22			
4.4.3	Need for Energy Audit	4-22			
4.4.4	Energy Audit Steps	4-23			
4.4.5	Types of Energy Audits	4-24			
4.4.5.1	Preliminary Energy Audit or Walk-through (PEA)	4-24			
4.4.5.2	Targeted Energy Audits	4-26			
4.4.5.3	Detailed Energy Audit (DEA).....	4-26			
4.4.6	Phases of Detailed Energy Audit.....	4-27			
4.4.7	Ten Steps Methodology for Detailed Energy Audit.....	4-28			
4.4.8	Case study of Energy Audit for Institution/University.....	4-29			
4.4.9	Energy Conservation Measures : Classification....	4-33			
4.4.10	Reporting Format for Energy Audits	4-34			
4.4.11	Benchmarking Energy Performance Permits.....	4-35			
4.4.12	Plant energy performance (PEP).....	4-36			
4.4.13	Production factor	4-36			

UNIT V**Chapter 5 : Agricultural Equipment and
Post Harvest Technologies 5-1 to 5-20****Syllabus :**

- 5.1 Tillers, Sowing and Planting equipment, Weeding Machines, Spraying Machines, Harvesting, Post harvesting Machineries
- 5.2 Elements of Cold chain
- 5.3 National Cooling Action Plan (NCAP)

5.1	Introduction	5-1
5.1.1	Tillers	5-2
5.1.2	Sowing and Planting Equipment	5-3
5.1.3	Weeding Machines	5-5
5.1.4	Spraying Machines	5-6
5.1.5	Harvesting and Post Harvesting Machineries.....	5-8
5.1.5.1	Harvesting	5-8
5.1.5.2	Harvesting and Threshing Methods.....	5-8
5.1.5.3	Types of Thresher	5-9
5.1.5.4	Tractors in Agriculture	5-12
5.2	Elements of Cold Chain	5-13
5.2.1	The Cold Chain Process.....	5-13
5.2.2	Main elements in the cold chain	5-13
5.2.3	Examples of Industries that use Cold Chain.....	5-14
5.3	National Cooling Action Plan (NCAP)	5-14
5.3.1	Rise in requirement for Cooling in India	5-15
5.3.2	India Cooling Action Plan (ICAP).....	5-15
	• Multiple Choice Questions	5-16