

Syllabus ODD SEMESTER
Annexure-I
VII Semester – Automobile Engineering

Sr. No.	Course Code	Course Name	L	T	P	Credits
1		Program Elective VII-1	3	0	0	3
2		Program Elective VII-2	3	0	0	3
3		Open Elective VII-1	3	0	0	3
4	AU3PC01	Project Work I	0	0	8	4
5	AU3PC03	Industrial Training	0	2	0	2
		Total	9	2	8	15
		Total Contact Hours	19			

Program Elective VII-1

- 1 AU3EL06 - Hybrid Vehicles
- 2 AU3EL03 - Earth Moving Equipments

Open Elective - VII-1

- 1 OE00047- Advance Machining Processes
- 2 OE00048-Supply Chain Management

Program Elective VII-2

- 1 AU3EL10 – Tractor and Farm Equipments
- 2 AU3EL01 Alternative Fuels

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Course Code	Course Name	Hours per Week			Total
		L	T	P	Credits
AU3EL06	Hybrid Vehicles	3	0	0	3

UNIT I

Electric And Hybrid Electric Vehicles: Configuration of Electric Vehicles, Performance of Electric Vehicles, Traction motor characteristics, Tractive effort and Transmission requirement, Vehicle performance, Tractive effort in normal driving, Energy consumption Concept of Hybrid Electric Drive Trains, Architecture of Hybrid Electric Drive Trains, Series Hybrid Electric Drive Trains, Parallel hybrid electric drive trains.

UNIT II

Energy Storage for EV & HEV: Energy storage requirements, Battery parameters, Types of Batteries, Modelling of Battery, Fuel Cell basic principle and operation, Types of Fuel Cells, Super Capacitors,

UNIT III

Electronic Converter For Battery Charging: Charging methods for battery, Termination methods, charging from grid, The Z - converter, Isolated bidirectional DC - DC converter, Design of Z - converter for battery charging, High -frequency transformer based isolated charger topology,

UNIT IV

Electric Propulsion: EV consideration, DC motor drives and speed control, Induction motor drives, Permanent Magnet Motor Drives, BLDC motor, Switch Reluctance Motor Drive for Electric Vehicles, Configuration and control of Drives.

UNIT V

Design of Electric & Hybrid Electric Vehicles: Series Hybrid Electric Drive Train Design: Operating patterns, control strategies, Sizing of major components, power rating of traction motor, power rating of engine /generator.

Text Books:

1. M. Ehsani, Y. Gao, S. Gay and Ali Emadi, Modern Electric, Hybrid Electric, and Fuel Cell.
2. Vehicles: Fundamentals, Theory, and Design, CRC Press
3. Iqbal Husain, Electric and Hybrid Vehicles: Design Fundamentals, CRC Press

Reference Books:

1. C.C. Chan and K.T. Chau, Modern Electric Vehicle Technology, OXFORD University Press
2. Chris Mi, M. AbulMasrur, David Wenzhong Gao, Hybrid Electric Vehicles Principles and Applications with Practical Perspectives, Wiley Publication
3. Sheldon S. Williamson, Energy Management Strategies for Electric and Plug - in Hybrid Electric Vehicles, Springer

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Course Code	Course Name	Hours per Week			Total
		L	T	P	Credits
AU3EL03	Earth Moving equipment	3	0	0	3

UNIT I

Equipment's and Operations: Different types of earth moving equipment and their applications. Dozers, loaders, shovels, excavators, scrapers, motor graders, rollers, compactors, tractors and attachments, Types of soil.

UNIT II

Under Carriage and Suspension: Tyre and tracked vehicles, advantages and disadvantages, under carriage components like, tracks, roller frames, drive sprockets, track rollers, track chains and track shoes, rubber spring suspension and air spring suspension

UNIT III

Brakes and Hydraulics: Brakes: types of brakes; disc brake, engine brakes , Basic components of hydraulic systems, pumps (types of pumps), control valves, flow control valves, directional control valves and pressure control valves, hydraulic motors and hydraulic cylinders. Depth and draft control systems.

UNIT IV

Methods of Selection of equipment: Selection of machines, basic rules of equipment including the nature of operation, selection based on type of soil, selection based on haul distance, selection based on weather condition.

UNIT V

Calculation of Operating Capacity: Methods of calculating operating capacity, calculation of productivity of EMEs

Text Books:

1. Diesel equipment: volume I and II by Erich J. Schulz
2. Construction equipment and its management By S.C. Sharma
3. Farm machinery and mechanism by Donald R. Hunt and L. W. Garner

Reference Books:

1. Theory of ground vehicles by J.Y. Wong John Wiley and sons
2. Moving the earth by Herbert Nicholas
3. On and with the earth by Jagman Singh, W. Newman and Co. Culkatta

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Course Code	Course Name	Hours per Week			Total
		L	T	P	Credits
AU3EL10	Tractor and Farm Equipment	3	0	0	3

UNIT I

Introduction: Fundamental of Soils and machinery; different equipment, purposes and operations; Systems of Earth Moving equipment: Engine-all systems of engine and special features like automatic timer, turbochargers, after coolers; Transmission: - Basic types and planetary transmission constructional and working principles. Hydro shift automatic trans torque converters, retarders.

UNIT II

Hydraulics: Basic components of hydraulic systems like pumps (types); control valves, relief valves and hydraulic motors; hydraulic cylinders, circuits and controls valves.

UNIT III

Final Drive: Types of reductions, Structure and function suspensions like hydraulic suspension; brakes and steering: hydraulic power steering, main components and circuit; tire, brakes and components and functions. Advantages and disadvantages, tractor and components.

UNIT IV

Earth Moving equipment Management: Earth moving equipment; maintenance; type of maintenance schedules; purpose and advantages, method of selection of equipment: -Selection of machines, basic rules of matching machine, selection of equipment including the nature of operation; selection- based on type of soil, based on haul distance and weather condition.

UNIT V

Safety Norms of Tractor & Farm equipment: Safety Methods and attachment for earth moving equipment. Precautions to avoid accidents. Life safeguarding equipment & accessories

Text Books:

1. John B. Lizedaw et-al; Tractors and their power units
2. Donald R. Hum and LGV Garner; Farm machinery and mechanism
3. Jain S C, Farm Tractor: Maintenance and Repair, Standard Publishing House

References Books:

1. D N & S Mukesh Sharma, Farm Power and Machinery Management Vol. - I and II, Jain brothers
2. Ivan Gregg Morrison, Farm Tractor Maintenance, Jain Brothers

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Course Code	Course Name	Hours per Week			Total
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AU3EL01	Alternative Fuels	3	0	0	3

UNIT I

Biofuels Alcohol: Sources of Methanol and Ethanol, methods of its production. Properties of methanol & ethanol as engine fuels, Use of alcohols in S.I. and C.I. engines, performance of blending methanol with gasoline. **Bio-diesels:** Base materials used for production of Bio Diesel (Karanja oil, Neem oil, Sunflower oil, Soyabean oil, Mustard oil, Palm oil, Jatropha seeds, Algae). Process of separation of Bio Diesel.

UNIT II

Gaseous Fuels: LPG & CNG; Properties of LPG & CNG as engine fuels, fuel metering systems, combustion characteristics, effect on performance, storage, emission, cost and safety. **Hydrogen;** physical and chemical properties, Hydrogen storage for automobile applications.

UNIT III

Different Power Systems: Fuel cells principle, working, Thermodynamic analysis, Types, Fuel cell application in automobiles, **Electric-Fuel cell hybrid configurations,** Electric & Hybrid Vehicles, Topology of electric/hybrid systems, **Solar Powered Vehicles;** Solar cells for energy collection, Storage batteries, layout of solar powered automobiles, Advantages and limitations.

UNIT IV

Non-Conventional I.C. Engine: Introduction, Dual fuel / Multi fuel engine, stratified charge, adiabatic engine, Variable Compression Ratio engine, Free piston engine, Sterling engine, Wankel engine.

UNIT V

Other Alternative Fuels: Di-Methyl Ether (DME), Pyrolysis gas/oil, Synthetic gas/oil from plastic, rubber, coal, wood etc., Eco Friendly Plastic fuels (EPF).

Text Books:

1. Alternate Fuels by Dr. S. Thipse, Jaico Publications.
2. Bent Sorensen (Sorensen), Hydrogen and Fuel Cells: Emerging Technologies and Applications, Elsevier Academic Press, UK.
3. Iqbal Hussein, Electric and Hybrid Vehicles: Design Fundamentals, CRC Press

Reference Books:

1. Viswanathan, B and M AuliceScibioh, Fuel Cells – Principles and Applications, Universities Press.
2. MehrdadEhsani, YamiGao, Sebastin E. Gay, Ali Emadi, Modern Electric, Hybrid Electric and Fuel Cell Vehicles: Fundamentals, Theory and Design, CRC Press
3. James Larminie, John Lowry, Electric Vehicle Technology Explained, Wiley.

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Course Code	Course Name	Hours per Week			Total
		L	T	P	Credits
OE00047	Advance Machining Processes	3	0	0	3

UNIT I

Mechanical Type Processes: Limitations of conventional machining process, classification of advanced machining processes, **Classification of mechanical type processes** : Principle and mechanics of metal removal, calculation of MRR , process parameters and their effect on MRR, machine setup , advantages limitations and applications of - abrasive jet machining (AJM), ultrasonic machining (USM), water jet machining (WJM), recent developments in all the processes.

UNIT II

Chemical and Electrochemical Type Processes: Principle and mechanics of metal removal, calculation of MRR, process parameters and their effect on MRR , machine setup , advantages limitations and applications of - chemical machining (CHM), maskants and its type, methods of applying maskants, Electrochemical machining[ECM], electrolyte flow design in ECM.

UNIT III

Thermal Processes : Principle and mechanics of metal removal, calculation of MRR , process parameters and their effect on MRR , machine setup , advantages limitations and applications of - electric discharge machining(EDM), different circuits of pulsating dc supply, wire-cut EDM, transferred and non-transferred arc type plasma arc machining (PAM), Electron beam machining(EBM) and Laser Beam machining (LBM).

UNIT IV

Hybrid Processes: Principle and mechanics of metal removal, advantages, disadvantages and limitations of – abrasive electro-discharge machining (AEDM), ultra sonic assisted EDM (EDMUS), laser assisted ECM (ECML) , ultra sonic assisted ECM (USECM)

UNIT V

Hybrid Finishing Processes: Working principle, applications, advantages and limitations of - electrochemical grinding (ECG), electro-discharge grinding (EDG), electrochemical de-burring (ECD), electrochemical honing (ECH), magnetic abrasive finishing (MAF),

Text Books:

1. P.C. Pandey and H.S. Shan, "Modern Machining processes", McGraw Hill Education
2. M.K. Singh, "Unconventional Manufacturing Processes" New Age International
3. Hassan Abdel-Gawad El-Hofy, "Advanced Machining processes", McGraw Hill

Reference Books:

1. G.F. Benedict, Marcel Dekker, "Nontraditional Manufacturing Processes", Inc. New York.
2. Vijay.K. Jain, "Advanced Machining Processes" Allied Publishers.
3. Amitabha Ghosh and Asok Kumar Mallick, "Manufacturing Science", East West Press.

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Course Code	Course Name	Hours per Week			Total
		L	T	P	Credits
OE00048	Supply Chain Management	3	0	0	3

UNIT I

Introduction & Building a Strategic Framework to Analyze Supply Chains: An Introduction, Strategic view of supply chains, Evolution of Supply Chain Management (SCM), Importance of the supply chain, Decision phases in a supply chain, Process views of supply chain, Enablers of supply chain performance, Supply chain strategy and performance measures- competitive and supply chain strategies – Achieving strategic fit, managing material flow in supply chain

UNIT II

Designing the Supply Chain Network: Designing distribution networks and applications to e-business, network design in the supply chain, network designing an uncertain environment, supply chain planning, supply chain coordination, decision modeling for supply chain, green supply chain

UNIT III

Supply Chain Distribution and Integration and Risk Pooling: Supply chain integration, Warehouse Management Systems, Storage Systems, Material Handling Requirements, Distribution Strategies – Traditional Retail, Direct Shipping, Cross-docking, Cross-dock Operations, Distribution Strategies: Pool Distribution, Trans shipment, Milk-Run Systems, Classic Techniques of Risk Management, Pooling based on Location, Product, lead Time and capacity.

UNIT IV

Supplier Relationship Management: Integrating Suppliers into the e-Value Chain: Defining Purchasing and Supplier Relationship Management, Components of SRM, The Internet-Driven SRM Environment, e-SRM Structural Overview, e-SRM Services Functions, e-SRM Processing, e-SRM Technology Services, Anatomy of The e-SRM Marketplace Exchange Environment, Implementing e-SRM

UNIT V

Transportation and Packaging: Transportation – Drivers, Modes, Measures - Strategies for Transportation, 3PL and 4PL, Vehicle Routing and Scheduling. Packaging- Design considerations, Material and Cost. Packaging as Utilisation. Consumer and Industrial Packaging.

Text Books:

1. Ronald H. Ballou and Samir K. Srivastava, Business Logistics and Supply Chain Management, Pearson education
2. Sunil Chopra and Peter Meindl, Supply Chain Management-Strategy Planning and Operation, PHI Learning / Pearson Education
3. Mohanty R.P and Deshmukh S.G, Supply chain theories and practices, Biztaatra publications.

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Reference Books:

1. Bowersox Donald J, Logistics Management - The Integrated Supply Chain Process, Tata McGraw Hill
2. Vinod V. Sople, Logistics Management-The Supply Chain Imperative, Pearson.
3. Coyle et.al., The Management of Business Logistics, Thomson Learning

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