DR. BABASAHEB AMBEDKAR MARATHWADA UNIVERSITY,
CHHATRAPATI SAMBHAJINAGAR.

CIRCULAR NO.SU/B.Sc./CBC&GS/92/2024

It is hereby inform to all concerned that, the Revised syllabi prepared by the Ad-hoc Board and recommended by the Dean, Faculty of Science & Technology, **Academic Council at its meeting held on 08 April 2024 has accepted** the following Syllabi under the Faculty of Science & Technology **as per Norms of Choiced Based Credit Grading System** run at the Affiliated Colleges, Dr.Babasaheb Ambedkar Marathwada University as appended herewith.

Sr.No.	Courses	Semester
1.	**B.Sc.Automobile Technology (Degree)**	**Vth & VIth semester**
2.	**B.Sc.Workshop Technology (Degree)**	**Vth & VIth semester**
3.	**B.Sc.Refrigration and Air Conditioning (Degree)**	**Vth & VIth semester**

This is effective from the Academic Year 2024-25 and onwards.

All concerned are requested to note the contents of this circular and bring the notice to the students, teachers and staff for their information and necessary action.

University Campus,
Aurangabad-431 004.
REF.NO.SU/2024/26149-57
Date:- 15.05.2024

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Deputy Registrar,
Academic Section

Copy forwarded with compliments to :-

1] **The Principal of all concerned Colleges,**
Dr. Babasaheb Ambedkar Marathwada University,

2] **The Director, University Network & Information Centre, UNIC, with a request to upload this Circular on University Website.**

Copy to :-

1] The Director, Board of Examinations & Evaluation, Dr.Babasaheb Ambedkar Marathwada University, Chhatrapati Sambhajinagar.

2] The Section Officer,[B.Sc.Unit] Examination Branch, Dr.Babasaheb Ambedkar Marathwada University, Chhatrapati Sambhajinagar.

3] The Programmer [Computer Unit-1] Examinations, Dr.Babasaheb Ambedkar Marathwada University, Chhatrapati Sambhajinagar.

4] The Programmer [Computer Unit-2] Examinations, Dr.Babasaheb Ambedkar Marathwada University, Chhatrapati Sambhajinagar.

5] The In-charge,[E-Suvidha Kendra], Rajarshi Shahu Maharaj Pariksha Bhavan, Dr.Babasaheb Ambedkar Marathwada University, Chhatrapati Sambhajinagar.

6] The Public Relation Officer, Dr.Babasaheb Ambedkar Marathwada University, Chhatrapati Sambhajinagar.

7] The Record Keeper, Dr.Babasaheb Ambedkar Marathwada University, Chhatrapati Sambhajinagar.

Dr. Babasaheb Ambedkar Marathwada University
Aurangabad – 431004 (MS) India



Undergraduate Bachelor Degree Program

In Science& Technology

Automobile Technology [Vth & VIth Semester]

Course Structure and Curriculum

(Outcome Based Curriculum)

Choice Based Credit System

(Effective from Academic Year 2022-23)

Dr. Babasaheb Ambedkar Marathwada University
Aurangabad – 431004 (MS) India

Dr. Prashant Ambad

Dr. Babasaheb Ambedkar Marathwada University, Chhatrapati Sambhajinagar

Choice Based Credit System (CBCS) Curriculum For

Faculty of Science & Technology

Course Structure and Scheme of Examination

B.Sc. Automobile Technology Undergraduate Degree Program

Semester V

	Course Code	Course Title	Teaching Time / Week	Credits	Scheme of Examination			
					Max Marks	CIA	UA	Min Marks
Optional I (DSC-1 A) Discipline Specific Elective	AT-511	Select Any One Paper (A1) Automotive Electrical And Electronics System (B1) EV Charging Station Design-I	2 hours	2	50	10	40	20
	AT-512	Select Any One Paper (A2) Mechatronics-I (B2) Robotics-I	2 hours	2	50	10	40	20
	AT-521	Lab Course 6 Based on AT-511	3 hours	1.5	50	10	40	20
	AT-522	Lab Course 7 Based on AT-512	3 hours	1.5	50	10	40	20
Optional II (DSC-2 A) Discipline Specific Elective	AT-513	Select Any One Paper (A1) Automobile Troubles Maintenance And Testing –I (B1) Engine Emission Control-I	2 hours	2	50	10	40	20
	AT-514	Select Any One Paper (A2) Body Chassis Maintenance (B2) Quality Engineering & Industrial Management-I	2 hours	2	50	10	40	20
	AT-523	Lab Course 6 Based on AT-513	3 hours	1.5	50	10	40	20
	AT-524	Lab Course 7 Based on AT-514	3 hours	1.5	50	10	40	20
Optional III (DSC-3 A) Discipline Specific Elective	AT-515	Select Any One Paper (A1) Transport Management-I (B1) Automotive Refrigeration And Air Conditioning-I	2 hours	2	50	10	40	20
	AT-516	Select Any One Paper (A2) Special Purpose Vehicle (B2) Automobile Manufacturing Process-I	2 hours	2	50	10	40	20
	AT-525	Lab Course 6 Based on AT-515	3 hours	1.5	50	10	40	20
	AT-526	Lab Course 7 Based on AT-516	3 hours	1.5	50	10	40	20
Skill Enhancement Course (SEC 3)	AT-517	SEC-3 Any one Skills Chosen out of two SEC (E) : Leadership Skills SEC (F) : Entrepreneurship Skills	2 Hours	2	50	50	**	20
Non Credit Course / Additional Credits	AT-518	Professional Ethics and Moral Values	2 Hours	2*	50	10	40	20
			34 Hours	23	650	170	480	
Total Credits for Semester V : 23 (Theory : 14 ; Practical : 9)								

Dr. Prashant Ambad

Dr. Babasaheb Ambedkar Marathwada University, Chhatrapati Sambhajinagar

Choice Based Credit System (CBCS) Curriculum For

Faculty of Science & Technology

Course Structure and Scheme of Examination

B.Sc. Automobile Technology Undergraduate Degree Program

Semester VI

	Course Code	Course Title	Teaching Time / Week	Credits	Scheme of Examination			
					Max Marks	CIA	UA	Min Marks
Optional I (DSC-1B) Discipline Specific Elective	AT-611	Select Any One Paper (A1) Automation In Manufacturing (B1) EV Charging Station Design-II	2 hours	2	50	10	40	20
	AT-612	Select Any One Paper (A2) Mechatronics-II (B2) Robotics-II	2 hours	2	50	10	40	20
	AT-621	Lab Course 6 Based on AT-611	3 hours	1.5	50	10	40	20
	AT-622	Lab Course 7 Based on AT-512	3 hours	1.5	50	10	40	20
Optional II (DSC-2 B) Discipline Specific Elective	At-613	Select Any One Paper (A1) Automobile Troubles Maintenance And Testing –II (B1) Engine Emission Control-II	2 hours	2	50	10	40	20
	AT-614	Select Any One Paper (A2) Automotive Safety (B2) Quality Engineering & Industrial Management-II	2 hours	2	50	10	40	20
	AT-623	Lab Course 6 Based on AT-613	3 hours	1.5	50	10	40	20
	AT-624	Lab Course 7 Based on AT-614	3 hours	1.5	50	10	40	20
Optional III (DSC-3 B) Discipline Specific Elective	AT-615	Select Any One Paper (A1) Transport Management-II (B1) Automotive Refrigeration And Air Conditioning-II	2 hours	2	50	10	40	20
	AT-616	Select Any One Paper (A2) Alternative fuels and energy systems (B2) Automobile Manufacturing Process-II	2 hours	2	50	10	40	20
	AT-625	Lab Course 6 Based on AT-615	3 hours	1.5	50	10	40	20
	AT-626	Lab Course 7 Based on AT-616	3 hours	1.5	50	10	40	20
Skill Enhancement Course (SEC 3)	AT-617	Sec-4 Any one Skills Chosen out of two SEC (G) : Creative Abilities SEC (H) : Digital Skills	2 Hours	2	50	50	**	20
			32 Hours	23	650	170	480	
Total Credits for Semester V : 23 (Theory : 14 ; Practical : 9)								

Dr. Prashant Ambad

B.Sc. Automobile Technology (CBCS P-2022)

Semester V

AT-511:A1:- AUTOMOBILE ELECTRICAL & ELECTRONICS SYSTEM

Total Credits : 2	Teaching Time / Week: (2 /Week)
Marks: 50 (10 CA + 40 UA)	

Course Description:

In this course, students delve into the fundamental aspects of electrical and electronic systems in automobiles. They gain a deep understanding of various electrical accessories, such as wipers, horns, and lighting components, and their critical role in enhancing vehicle functionality and safety. The course covers charging systems, including dynamos, alternators, and modern electronic charging systems, illuminating the heart of a vehicle's power supply. Students are introduced to the workings of automotive lighting systems and electrical symbols. Practical skills in maintenance and troubleshooting are honed, preparing students for real-world challenges. The course also explores emerging trends and career prospects in the ever-evolving automotive electrical and electronic landscape.

Course Objectives:

- To introduce students to the fundamental concepts of electrical systems in automobiles.
- To provide an understanding of the operation and components of the charging system in vehicles.
- To familiarize students with the principles of automotive lighting systems, electrical symbols, wiring diagrams.
- To instill a basic understanding of electronic ignition systems, their components, and their role in the ignition process.
- To prepare students for the practical aspects of automotive electrical systems.

Course Outcomes:

Upon successful completion of this course, students should be able to:

- Identify and explain the functions and significance of various electrical accessories in automobiles.
- Analyze the charging system in vehicles, including the operation of dynamos and alternators.
- Interpret electrical symbols and wiring diagrams, enabling students to work.
- Describe the operation of electronic ignition systems, recognizing the components and their functions in ignition processes.
- Demonstrate basic maintenance and troubleshooting skills related to automotive electrical systems.

Syllabus

Unit 1: Battery Operations **(4 Hrs)**

- Introduction to the Automobile Electrical System
- Types of Batteries in Automobiles
- Maintenance-Free Batteries and Their Advantages
- Dry Charged Batteries and Their Characteristics
- Understanding Battery Rating and Capacity

Unit 2: Charging System **(4 Hrs)**

- Importance of the Charging System in Automobiles
- System Layout and Components, Dynamo: Construction, Function, and Operation
- Alternator: Construction, Operation, and Advantages
- Voltage Regulation in Charging Systems

Unit 3: Automotive Lighting System **(5 Hrs)**

- Understanding Electrical Symbols in Automobiles, Wiring Systems and Their Importance
- Wiring Diagrams of Various Automotive Lights, Sizing of Wires for Optimal Lighting
- Instrument Panel Components and Functions
- Fuses in Automotive Electrical Systems

Unit 4: Electrical Accessories **(7 Hrs)**

- Windshield Wiper and Wiper Motor, Automobile Horns and Their Functions
- Heaters in Automobiles, Power Windows and Their Operation
- Speedometers and Odometers, Headlamps in Automobiles
- Temperature Gauges , Oil Pressure Gauges, Fuel Level Gauges
- Key less Entry Systems in Modern Vehicles

Unit 5: Electronic Ignition System **(5 Hrs)**

- Introduction to Electronic Ignition Systems (CDI), Components
- Spark Advance Mechanisms in Ignition Systems
- Benefits and Advancements in Electronic Ignition

Unit 6: Starting System **(5 Hrs)**

- Function and Importance of Starting Systems
- Layout and Various Components of Starting Systems
- Starting Motor: Construction and Working, Solenoids and Relays
- Starter Drives and Their Functions
- Starting Systems in Two-Wheeler, Electrically Assisted Starting Systems

Reference Books:

1) "Auto Mechanics Guide to Electronic Instrumentation" by Lynn Mosher, Publisher: Prentice Hall, New Jersey, 1987.
2) "Automotive Electronics & Compression-Controlled Lighting System" by Don Knowles, Publisher: Prentice Hall Inc., New Jersey, 1988.
3) "Advanced Electronics Diagnosis of Automobile" by Don Knowles, Publisher: Prentice Hall Inc., New Jersey, 1988.
4) "Auto Mechanics Understanding New Technology" by Don Knowles, Publisher: Prentice Hall Inc., New Jersey, 1988.
5) "Santro and Accent Basic Training Book" by Publisher - Hyundai Motors.
6) Service Manuals of all Euro II & Euro IV Cars, Publisher: Maruti Udyog India Ltd.
7) "Automobile Electrical & Electronic Equipment" by Young & Griffiths, Revised by G. E. Fardin, Publisher: The English Language Book Society & Newness-Butterworths, London.
8) "Automotive Electricals" by Arthur Judge.
9) "Automotive Electricals" by Kohli.

AT-511:B1:- EV CHARGING STATION DESIGN -I

Total Credits : 2	Teaching Time / Week: (2 /Week)
Marks: 50 (10 CA + 40 UA)	

Course Description:

EV Charging Station Design - 1 is a comprehensive course focused on the design and infrastructure of electric vehicle (EV) charging stations. This course delves into the history and technology behind electric vehicles, comparing them to traditional internal combustion engines. It explores the various types of EV chargers, including slow and fast chargers, and the associated technologies. The course also covers the selection, sizing, and specifications for charging equipment, communication protocols, and central management systems.

Course Objectives:

1. To provide a historical perspective and understanding of the components of electric vehicles.
2. To compare the technology, benefits, and challenges of electric vehicles with internal combustion engines.
3. To introduce different types of EV chargers, charging equipment, and associated block diagrams.
4. To explain the differences between slow and fast chargers, including their design and specifications.
5. To cover topics related to EV charger communication protocols, central management systems, and payment applications.

Course Outcomes:

Upon completion of this course, students will be able to:

1. Describe the historical evolution and components of electric vehicles.
2. Analyze the technology and advantages of electric vehicles in comparison to internal combustion engines.
3. Differentiate between various types of EV chargers and understand their block diagrams.
4. Calculate and specify the design ratings of slow and fast chargers (AC and DC).
5. Explain communication protocols, central management systems, and payment applications associated with EV chargers.
6. Apply knowledge of EV charging station design to practical projects and real-world applications.

Syllabus

Unit 1: Introduction: Electric Vehicle **(5 Hrs)**

- History of EV, Components of Electric Vehicle, Comparison with Internal combustion Engine : Technology
- Comparison with Internal combustion Engine: Benefits and Challenges
- EV classification and their electrification levels,EV Terminology

Unit 2: Types of EV Chargers **(12 Hrs)**

- Electric Vehicle Technology and Charging Equipment's, Basic charging Block Diagram of Charger
- Difference between Slow charger and fast charger, Slow charger design rating, Fast charger design rating
- AC charging and DC charging, Inboard and off board charger specification
- Type of Mode of charger Mode -2 , Mode-3 and Mode-4, EVSE associated charge times calculation

Unit3: Selection and sizing of fast and slow charger (AC & DC) **(13 Hrs)**

- AC Pile Charger, DC Pile Charger, EVSE Power Module selection and technical specification
- Selection of EVSE Communication Protocol (PLC / Ethernet / Modbus/ CAN Module), Communication gateway
- Specification of open charge point protocol (OCCP 1.6/2.0), Bharat DC001 & AC001 Charger specification
- Communication Interface between charger and CMS (central management system), Payment apps

Reference Books:

1. "Electric Vehicle Technology Explained" by James Larminie and John Lowry
2. "Electric Vehicle Charging Infrastructure" by S.M. Islam, K.T. Chau, and S. Kar
3. "Electric Vehicle Integration into Modern Power Networks" by Sumedha Rajakaruna and Ananda S. Ranasinghe

AT-512:A2:- MECHATRONICS-I

Total Credits : 2	Teaching Time / Week: (2 /Week)
Marks: 50 (10 CA + 40 UA)	

Course Description:

This course provides an introduction to the fundamental concepts and building blocks of Mechatronics, focusing on digital electronics, logic design, and operational amplifiers. Students will learn the principles of number systems, Boolean algebra, logic gates, sequential logic, operational amplifiers, and electronic timers. The course combines theory and practical applications, enabling students to design and analyze digital circuits and systems commonly used in Mechatronics devices.

Course Objectives:

1. Introduce students to the core principles of digital electronics
2. Familiarize students with Boolean algebra and its application in simplifying logic functions
3. Teach students about sequential circuits and understand their role in Mechatronics systems.
4. Provide a comprehensive understanding of operational amplifiers
5. Introduce students to electronic timers, enhancing their practical skills in Mechatronics.

Course Outcomes:

Upon successful completion of this course, students will be able to:

1. Apply knowledge of number systems and binary arithmetic to perform conversions digital data effectively.
2. Analyze and design logic circuits to solve complex digital logic problems.
3. Design and implement sequential logic circuits, for Mechatronics applications.
4. Utilize operational amplifiers for various linear and nonlinear applications.
5. Implement electronic timer circuits and Schmitt triggers for precise timing control in Mechatronics systems.

Syllabus

Unit 1: Introducing Mechatronics **(2 Hrs)**

- What is Mechatronics? Systems , Measurement systems , Control systems .
- Microprocessor-based controllers, Response of systems.

Unit 2: Number Systems and Boolean Algebra **(10 Hrs)**

- Introduction to Number Systems:- TYPES OF various number systems, Conversions between different number systems (binary, decimal, octal & hexadecimal number).
- Logic Gates and Basic Logic Operations:- Introduction to logic gates (AND, OR, NOT, etc.).Basic logic operations and truth tables. , Derived Gates and Arithmetic Circuits:- Special logic gates (NAND, NOR, XOR, XNOR, etc.).
- Boolean algebra:-Principles of Boolean algebra, Boolean expressions and simplification.

Unit 3: Sequential Logic Circuits **(7Hrs)**

- Introduction of Flip-Flops and Their Types (SR, D, JK, T)., Shift Registers: - SISO, PISO, SIPO, PIPO.
- Introduction to counters in digital circuits. (Synchronous, asynchronous, up/down).
- Timers: - Schmitt trigger, 555 Timer and its applications in signal conditioning.

Unit 4: Combinational AND ARITHMATIC Logic Circuits **(7Hrs)**

- Half Adder , Full Adder. Half Subtractor, Full Subtractor
- D/A Converters, A/D Converters, Multiplexer, Demultiplexer

Unit 5: Operational Amplifiers (Op-Amps) Introduction **(4 Hrs)**

- Introduction , Op-Amps Parameters, Linear Application of Op-Amps , Non- Linear Application of Op-Amps

References:-

1. Modern Digital Electronics by R.P. Jain
2. Introduction to Mechatronics and Measurement Systems by David Glciator.Michael B Histand .
3. Mechatronics by W.Bolton
4. Mechatronicsby HMT Limited

AT-512: B2:- ROBOTICS-I

Total Credits : 2	Teaching Time / Week: (2 /Week)
Marks: 50 (10 CA + 40 UA)	

Course Description:

This course on Robotics provides an in-depth understanding of the fundamental principles, components, and technologies that underlie robotic systems. It covers topics ranging from the basics of robotics to the anatomy of robots, their classification, drive technology, and actuation methods. The course also delves into the design and analysis of end effectors, actuators, and motors used in various robotic applications.

Course Objectives:

1. To provide students with a comprehensive introduction to the field of robotics.
2. To familiarize students with the various classifications of robots based on their design, mobility, and application.
3. To delve into the components that make up a robot, including drive technology, envelope geometry.
4. To equip students with the knowledge and skills needed to design and analyze robot end effector.
5. To provide a comprehensive understanding of different types of actuators, including hydraulic, pneumatic, linear, rotary, and electric actuators, as well as motors such as servo and stepper motors.

Course Outcomes:

Upon completing this course, students will be able to:

1. Describe the fundamentals of robotics, its historical development, and its role in automation.
2. Categorize robots based on their design and application, highlighting the diverse types of robots
3. Understand the significance of drive technology, envelope geometry, and motion control methods in robot design.
4. Develop and analyze end effector s considering gripper force and design principles.
5. Evaluate the advantages, limitations, and applications of various actuators, motors.
6. Apply the gained knowledge to real-world applications.

Syllabus

Unit 1: FUNDAMENTALS OF ROBOTICS **(8Hrs)**

- Definition and history of robot, Automation and robotics
- Robot anatomy, Robot classification, Drive technology, Envelope geometry
- Motion control method, Robot speciation

Unit 2: ROBOT END EFFECTORS **(8Hrs)**

- Mechanical gripper- types of gripper mechanism
- Types of grippers. Vacuums, Magnetic, Adhesive gripper.
- Tool as end effector, Gripper force analysis and design,

Unit 3: ROBOT ACTUATOR **(14 Hrs)**

- Introduction of actuator,
- Hydraulic actuator:- Classification of hydraulic actuator, Advantage of hydraulic motor, application and limitations
- Hydraulic motor:- types of hydraulic motor, Advantage of hydraulic motor, application and limitations
- Pneumatic actuator:- working principle of pneumatic actuator, types, advantages, application and limitations
- Linear actuator:- working principle of linear actuator, types, advantages, application and limitations
- Rotary actuator:- working principle of rotary actuator, types, advantages, application and limitations
- Electric actuator :- working principle of electric actuator, types, advantages, application and limitations
- D.C. servo motor
- A.C. servo motor,
- Steeper motor.

Reference Books:

1. "Industrial Robotics"(Technology Programming and application) by M.P. Groover, M.Weiss, R.N. Nagel, N.G. Odrey McGraw, Hill 1996
2. S.R. Deb "Robotics Technology and Flexible Automation", Tata McGraw Hill 1994
3. K.S. Fu, R.C. Gonzalez and C.S.G. Lee "Robotics: Control, Sensors, Vision andUnintelligence", MCGraw-Hill 1987

AT-521: Practical Based on AT 511

Total Credits : 1.5	Teaching Time / Week: (3 /Week)
Marks: 50 (10 CA + 40 UA)	

AT-511:A1:- AUTOMOBILE ELECTRICAL & ELECTRONICS SYSTEM

1. Study of dry Batteries and constructions.
2. Study of Batteries charging
3. Testing, dismantling and assembling of starter motor used in automobile.
4. Testing, dismantling and assembling of alternator used in automobile.
5. Study of different color code system used in automotive wiring system
6. Demonstration and experiment on lighting system of two wheeler and Four Wheeler.
7. Study of Windshield Wiper & Motor, Horn, Power Window, Heater, Head Lamps
8. Study of Fuel Level Gauge, Speedometer, Odometer
9. Study of Temperature Gauges, Oil Pressure Gauge
10. Study of Electronic Ignition System, Sparks Advance Mechanism
11. Study of Solenoid And Relays, Starter Drive & Starting System In Two Wheeler

AT-511:B1:- EV CHARGING STATION DESIGN -I

1. Discuss the challenges associated with EVs, such as range anxiety, charging infrastructure, and battery recycling.
2. Visit a local EV charging station (if feasible) and identify different types of chargers (slow, fast, AC, DC).
3. Analyze the specifications and functionalities of each charger type using manufacturer manuals or online resources.
4. Compare the layout and functionality of EV components with traditional internal combustion engines.
5. Use simulation software or drawing tools to create a block diagram of a simple EV charger, outlining the power flow and key components.
6. Consider factors like voltage, current, and charging efficiency in the calculations
7. Discuss the advantages and limitations of high-power charging technologies.
8. Utilize simulation tools or demonstrations to understand how these protocols enable communication between chargers and central management systems.
9. If possible, arrange a visit to a training facility with operational AC and DC charging piles
10. Consider factors like efficiency, heat dissipation, and cost-effectiveness in the selection process

AT-522: Practical Based on AT 512

Total Credits : 1.5	Teaching Time / Week: (3 /Week)
Marks: 50 (10 CA + 40 UA)	

AT-512:A2:- MECHATRONICS-I

1. To study of binary addition half adder, full adder, 2 bit binary parallel adder
2. To study of binary substraction
3. To study of binary gray code conversion
4. To study operation of all logic gates
5. To study of flip flops
6. To study of shift resister
7. To study of 4 bit binary up-down counter
8. To study of johnsons counter
9. To study of analog to digital converter (adc)
10. To study of 555 timers

AT-512: B2:- ROBOTICS-I

1. To Study Of Robot anatomy
2. To Study Of Motion control method
3. To Study Of Mechanical gripper
4. To Study Of Gripper force analysis and design
5. To Study Of Hydraulic actuator & Motor
6. To Study Of Pneumatic actuator & Motor
7. To Study Of Linear, Rotary, Electric actuator
8. To Study Of D.C. servo motor
9. To Study Of A.C. servo motor
10. To Study Of Steeper motor

AT-513:A1:- AUTOMOBILE TROUBLES MAINTENANCE AND TESTING -I

Total Credits : 2	Teaching Time / Week: (2 /Week)
Marks: 50 (10 CA + 40 UA)	

Course Description:

It is an introductory course that provides students with a comprehensive understanding of common engine troubles, servicing procedures, inspections, and repairs related to automobile engines. The course also covers engine tune-up, maintenance practices, and performance characteristics, preparing students for effective maintenance and troubleshooting in the automotive industry. This course equips students with practical knowledge and skills in diagnosing, servicing, and maintaining automotive engines, enhancing their abilities to address engine troubles and ensure the efficient operation of vehicles. Students will also learn how to conduct engine testing and analyze engine performance characteristics.

Course Objectives:

1) To enable students to diagnose various engine troubles.
2) To teach students the principles and procedures for servicing engine systems.
3) To familiarize students with the inspection, servicing, and repair of engine components.
4) To provide students with the skills needed to perform engine tune-up tasks.
5) To introduce students to different types of maintenance.

Course Outcomes:

Upon completing this course, students will be able to:

1) Identify and troubleshoot common problems related to starting, power, noise, misfires, and various engine systems.
2) Understand the principles and practices of servicing engine systems.
3) Inspect and repair engine components.
4) Carry out engine tune-up tasks.
5) Understand different types of maintenance. Create and follow maintenance schedules.

Syllabus

Unit 1:Engine Troubles: - **(5 Hrs)**

- Engine does not start, Engine start but stop immediately Engine looses power,
- low fuel economy, engine produces noise, engine does not stay on ideal speed, Engine misfire,
- cooling system trouble, Ignition system trouble,
- lubrication system trouble, charging system trouble,
- Starting system trouble fuel supply system troubles for petrol & diesel engine.

Unit 2: Servicing of Engine Systems:- **(4 Hrs)**

- fuel supply, Ignition, cooling,
- lubrication, clutch, gear box,
- Differential, suspension, Brake, steering etc.

Unit 3: Inspection Servicing & Repairs: - **(4 Hrs)**

- various components of engine parts such as cylinder, piston, piston ring, connecting rods,
- Crank shaft, valves, cam shaft, bearings etc. sealants & adhesives in servicing & maintenance duty.

Unit 4: Engine Tune-up Engine servicing minor repair :- **(5 Hrs)**

- Like Tappet setting, carburetor tune-up,
- timing setting, spark plug Cleaning & testing,

- Fuel supply system, Lubrication system checkup.

Unit 5: Engine Maintenance: - **(4 Hrs)**

- Introduction, types of maintenance.
- Preventive, breakdown, periodic maintenance -daily, weekly, monthly, scheduled.
- Maintaining interior cleaning, maintaining exterior cleaning, and maintenance schedules charts.

Unit 6: Engine Testing:- **(4 Hrs)**

- Introduction, Types of test, Engine tune-up tester, condensed test procedure, test report.

Unit 7: Performance Characteristics of Engine:- **(4 Hrs)**

- Terminology, Engine power,
- IHP, BHP, FHP, SAE power, Relation between torque & speed,
- Efficiency-mechanical, thermal, overall, volumetric, air standard,
- Relative Effect of compression ratio on efficiency, performance curves, Morse test, Heat balance sheet numerical.

Reference books

1. "Automobile Engineering" by R.K. Rajput
2. "Automobile Engineering VOL-1" by Kirpal Singh
3. "Automobile Engineering VOL-2" by Kripal Singh
4. "Automobile Engineering" by Dr. G. B. S. Narang
5. "Automobile Engineering" by Dr. B.L. Singal

AT-513:B1:- ENGINE EMISSION CONTROL - I

Total Credits : 2	Teaching Time / Week: (2 /Week)
Marks: 50 (10 CA + 40 UA)	

Course Description:

This course, "Engine Emission Control - 1," delves into the critical aspects of alternative fuels and emission control in internal combustion (IC) engines. It is designed to provide students with comprehensive knowledge of the mechanisms, regulations, and technologies surrounding engine emissions. The course aims to create awareness about the environmental and regulatory challenges faced by the automotive industry and equip students with the tools to address them effectively.

Course Objectives:

1. To Understand Awareness of Alternative Fuels.
2. To Understand Emission Norms.
3. To Understand Emission Measurement Techniques.
4. To Understand Emission Formation Mechanisms.

Course Outcomes:

Upon completing this course, students will achieve the following:

1. Will be able to explain the properties and characteristics of various alternative fuels suitable for IC engines.
2. Will be capable of analyzing the mechanisms behind the formation of pollutants in IC engine emissions.
3. W ill select and apply appropriate emission measurement techniques based on the latest technologies in the field.
4. Will describe and differentiate between the BS norms and European norms governing automotive vehicles.
5. Will evaluate and analyze different emission control technologies suitable for IC engines

Syllabus

Unit 1: Conventional Fuels and Need of alternative fuels **(8 Hrs)**

- Estimate of petroleum reserve and availability -
- comparative properties of fuels- diesel and gasoline,
- quality rating of SI and CI engine fuels,
- fuel additives for SI and CI engines.
- Thermodynamics of fuel combustion.
- Need of alternative fuels, applications, types etc.

Unit 2: Gaseous Fuels and Biofuel **(8 Hrs)**

- Sources of fuels – Bio fuels ,
- Edible & non edible vegetable oils,
- hydrogen,
- LPG, CNG, Bio gas,
- Methanol & Ethanol,
- Engine modification required to use alternative fuels,
- Dual fuel engine,
- Fuel efficiency, Fuel requirement,
- Production methods, Availability,
- Engine performance and Emission Characteristics with alternative fuels.

Unit 3: Emission Formation in IC Engine **(4 Hrs)**

- Automobile emission scenario,
- Sources of emission from vehicle,
- Formation of pollutants, CO, NOx, UBHC, Soot & Particulate formation,
- emissions effect on human health.

Unit 4: EMISSIONS IN SI ENGINE **(5 Hrs)**

- Chemistry of SI engine combustion –
- HC and CO formation in SI engines –
- NO formation in SI engines –
- Smoke emissions from SI engines –
- Effect of operating variables on emission formation.

Unit 5: EMISSIONS IN CI ENGINE **(5 Hrs)**

- Basics of diesel combustion –
- Smoke emission and its types in diesel engines –
- NOx emission and its types from diesel engines –
- Particulate emission in diesel engines.
- Odor, sulfur and Aldehyde emissions from diesel engines –
- effect of operating variables on emission formation.

Text Book:

1. B. P. Pundir, "Engine Emissions", Narosa Publications, Faculty of Science and Technology Savitribai Phule Pune University, Pune ,Syllabus for final Year of Automobile Engineering
2. S. S. Thipse "Alternative Fuels", Jaico publications.
3. E.F. Oberts, "Internal Combustion Engine and Air Pollution", Harper & Row Publisher, NY.
4. M. L. Mathur and R. P. Sharma, "Internal Combustion Engine", Dhanpat Rai Publication.

Reference Books:

1. J.G. Giles, "Vehicle Operation & Testing", (Automotive Vehicle Technology Vol. 7) C.H. Fisher, Carburetion, Vol. 4.
2. A.W. Judge, "Carburetion and Fuel Injection System", Motor Manual, Vol. 2, the Caxton Pub. Co. Ltd., London.
3. G.B.S. Narang, "Automobile Engineering", CBS Publishers & Distributors, Delhi.
4. F. Schafar & R van Basshuysen, "Reduced Emission and Fuel Consumption in Automobile Engine", Springer-Verlag Wien New York.
5. Richard L.Bechtold, "Alternative Fuels", Guidebook.

AT-514: A2:- BODY CHASSIS MAINTENANCE

Total Credits : 2	Teaching Time / Week: (2 /Week)
Marks: 50 (10 CA + 40 UA)	

Course Description:

IT is the first part of a two-part course in automobile engineering. This segment focuses on the fundamentals of vehicle frames and bodies. Students will explore various frame construction techniques, understand the different types of vehicle bodies, and gain insights into design considerations, safety aspects, and interior features. The course will also cover key topics related to vehicle safety and its materials.

Course Objectives:

1) Understand the construction and various types of frames and chassis for both two and four-wheeled vehicles.
2) Differentiate between conventional integral, semi-integral, and frameless vehicle structures.
3) Analyze the different types of vehicle bodies, their characteristics, and their significance in vehicle design.
4) Explain the significance of safety-based design, including airbags, safety belts, and safe driving practices.
5) Evaluate vehicle specifications and noise and vibration performance testing.

Course Outcomes :

1) Students will be able to analyze and differentiate between various types of vehicle frames and chassis.
2) Students will develop a comprehensive understanding of different vehicle body types and their key components.
3) Students will have the knowledge and skills to identify and address safety-based design aspects in vehicles.
4) Students will gain proficiency in understanding the importance of vehicle specifications.
5) Students will be able to comprehend the principles and techniques of vehicle body repair and painting.

Syllabus

Unit 1: Frame **(7 Hrs)**

- Introduction to Body Chassis Maintenance, Frame Construction and Types for Two & Four Wheeler
- Types of Sections in Frame Design, Conventional Integral Frames, Semi-Integral Frames
- Frame less Structures, Frame Alignment

Unit 2: Body & Its Types **(5 Hrs)**

- Vehicle Body Types and Their Significance, Essential Components of Vehicle Bodies
- Aerodynamics and Its Role in Body Design, Roof, Doors, and Windows in Vehicle Bodies, Windshields,
- Noise, and Vibrations in Vehicle Design, Car Interior Decoration and Its Importance
- Types of Vehicle Bodies (Saloon, Coach, Double Decker), Energy Absorbing Bumpers, Interior Trimming

Unit 3: Body Repair & Painting **(10 Hrs)**

- Denting and Patchwork in Body Repair, Body Welding , Repair Techniques
- Body Painting Process, Precautions in Painting and Paint Types, Equipment Used in a Painting Shop
- Painting Workshop Safety Measures

Unit 4: Interior Decoration **(8 Hrs)**

- Internal Cushioning , Seat Arrangement, Glass Windows, Power Windows, Glass Beading
- Center Locking , Wipers Mechanism
- Vehicle Interior Design and Customization

Reference Books:

1) "Automotive Chassis and Body" by Pankaj and Vimal Kumar, Tata McGraw-Hill Education.
2) "Automobile Engineering" by Kirpal Singh, Standard Publishers Distributors.
3) "Automotive Mechanics" by William Crouse and Donald Anglin, McGraw-Hill Education.
4) "Automotive Technology: A Systems Approach" by Jack Erjavec, Cengage Learning.
5) "Vehicle Body Engineering" by Adrian Biran, Butterworth-Heinemann.
6) "Automotive Air Conditioning and Climate Control Systems" by Steven Daly, Butterworth-Heinemann.

AT-514: B2:- QUALITY ENGINEERING & INDUSTRIAL MANAGEMENT-I

Total Credits : 2	Teaching Time / Week: (2 /Week)
Marks: 50 (10 CA + 40 UA)	

Course Description:

This course is designed to provide students with an understanding of fundamental concepts related to quality engineering and industrial management. It covers topics such as quality philosophy, motivation, process management, and the cost of quality. Students will gain knowledge and skills that are essential for effective management in industrial settings.

Course Objectives:

1. To introduce students to the goals and principles of management in organizations.
2. To provide insights of quality, its history, and its connection to productivity and quality improvement.
3. To familiarize students with motivation theories and behavioral aspects of employees in organizational settings.
4. To explore the concepts of process management, including process choice, design, and improvement.
5. To understand the cost of quality and its impact on organizational performance.

Course Outcomes:

Upon completion of this course, students will be able to:

1. Describe the fundamental goals and principles of management in organizations.
2. Explain the philosophy of quality and its development, as well as its impact on productivity and quality improvement.
3. Analyze motivation theories and their application to employee behavior in organizations.
4. Evaluate various aspects of process management, including process choice, design, and improvement.
5. Understand the concept of the cost of quality, its components, and its significance in managing organizational performance.

Syllabus

Unit 1: Introduction **(3 Hrs)**

- Goals of managers and Organizations, Scientific management,
- Principal of management, Behavioral science, Fayola operational management.

Unit 1: Quality Philosophy **(12 Hrs)**

- The meaning of quality & quality improvement ; Brief history of quality methodology,
- Quality Goals & quality policies, Quality Characteristics, Sporadic and chronic quality problems,
- Total Quality management- Quality philosophy, Links betweenquality & productivity,
- quality improvement, Management mindset- Cornet stone forpreparing TQM,
- managing the transition of TQM. 5S, SIX SIGMA, WHY-WHY, 5H.

Unit 1: Motivation And Behavior **(5 Hrs)**

- Hawthorns studies and its findings, Maslow's theory, C and Y theory, Pretence ofneed and satisfaction of needs,
- Goal Oriented Behavior,Integration of organizationgoals and needs of employee.

Unit 1: Process Management **(7 Hrs)**

- Definitions of process management,
- Major process decision – Process choice,Vertical integration, resources flexibility,
- customer involvement, capital intensity,relationships between decision,
- service operation, Designing processes, Rearranging andprocess improvement.

Unit 1:The Cost of Quality **(3 Hrs)**

- Definition of the Cost of Quality, Quality Costs, Measuring Quality Costs,use ofQuality Cost information,
- Accounting Systems and Quality Management.

Reference Books:

1. "Principles of Management" by Koontz and O'Donnell
2. "Statistical Quality Control" by E.L. Grant and R.S. Leavenworth
3. "Essentials of Management" by Koontz and Weirich
4. "Management of Organizational Behavior" by Hersey, Paul, and Kenneth H.
5. "Operations Management: Strategy and Analysis" by Lee J. Krajewski and Larry P. Ritzman
6. "Organizational Behavior" by Stephen P. Robbins

AT-523: Practical Based on AT 513

Total Credits : 1.5	Teaching Time / Week: (3 /Week)
Marks: 50 (10 CA + 40 UA)	

AT-513:A1:- AUTOMOBILE TROUBLES MAINTENANCE AND TESTING -I

1. Perform trouble shooting and maintenance practical on Starting system
2. Perform trouble shooting and maintenance practical on lubrication system
3. Perform trouble shooting and maintenance practical on cooling system
4. Perform trouble shooting and maintenance practical on fuel supply
5. Perform trouble shooting and maintenance practical on Valves
6. Perform trouble shooting and maintenance practical on Piston & Piston Rings
7. Perform trouble shooting and maintenance practical on Engine tune-up tester
8. Perform trouble shooting and maintenance practical on spark plug Cleaning & testing
9. Perform trouble shooting and maintenance practical on cam shaft, bearings etc
10. Perform trouble shooting and maintenance practical on Engine tune-up tester

AT-513:B1:- ENGINE EMISSION CONTROL - I

1. To Study of Sources of fuels
2. To Study of quality rating of SI and CI engine fuels
3. To Study of Thermodynamics of fuel combustion
4. To Study of Dual fuel engine
5. To Study of Formation of pollutants
6. To Study of emissions effect on human health
7. To Study of Chemistry of SI engine combustion
8. To Study of Effect of operating variables on emission formation in SI Engine
9. To Study of Smoke emission and its types in diesel engines
10. To Study of Effect of operating variables on emission formation in CI Engine

AT-524: Practical Based on AT 514

Total Credits : 1.5	Teaching Time / Week: (3 /Week)
Marks: 50 (10 CA + 40 UA)	

AT-514: A2:- BODY CHASSIS MAINTENANCE

1. Study of types of frames and frameless structure
2. Study of frame alignment
3. Study of types of body
4. Study of Aerodynamics and Its Role in Body Design
5. Study of Roof, Doors, and Windows in Vehicle Bodies
6. Study of Denting and Patchwork in Body Repair
7. Study of Body Painting Process
8. Study of Body Welding
9. Study of Internal Cushioning & Seat Arrangement
10. Study of Vehicle Interior Design and Customization

AT-514: B2:- QUALITY ENGINEERING & INDUSTRIAL MANAGEMENT-I

1. Study of and Applying Scientific Management Principles to a Case Study Company
2. Study of and Implementing 5S Methodology in a Simulated Workplace
3. Study of and Analyzing Maslow's Hierarchy of Needs in a Real-World Organization
4. Study of and Mapping a Service Process Flow (e.g., Bank Teller Interaction)
5. Study of and Calculating Quality Costs (Prevention, Appraisal, Failure) for a Sample Product
6. Study of and Developing a Quality Policy Statement for a Specific Industry
7. Study of and Designing a Customer Satisfaction Survey for a Chosen Service
8. Study of and Simulating Control Chart Analysis for Quality Control
9. Study of and Benchmarking Quality Improvement Practices from Leading Companies
10. Study of and Debating Traditional vs. Modern Management Techniques (in a structured discussion format)

AT-515: A1:- TRANSPORT MANAGEMENT - I

Total Credits : 2	Teaching Time / Week: (2 /Week)
Marks: 50 (10 CA + 40 UA)	

Course Description:-

IT is a comprehensive course that explores the organization and operation of passenger and goods transport systems. It covers various aspects of the transportation industry, including bus transport, goods transport, and logistics. The course emphasizes the management, organization, and logistics of transport services in both urban and rural settings.This course equips students with the knowledge and skills needed to effectively manage and operate both passenger and goods transport systems, fostering an understanding of the various elements, costs, and logistics involved in transportation. Students will also gain insights into the regulatory and compliance aspects of the transport industry.

Course Objectives:-

1) Provide students with an overview of the various modes of transportation.
2) Familiarize students with the organization and management of passenger and goods transport services.
3) Teach students how to calculate the cost of transport.
4) Discuss the infrastructure and layout of bus stations and depots, emphasizing the importance of efficient facilities.
5) Introduce students to the records and documentation required in the transport industry.

Course Outcomes:

Upon completing this course, students will be able to:

1) Differentiate between various modes of transportation and analyze their suitability for different contexts.
2) Set up and manage passenger transport systems, considering factors like scheduling, fares, and maintenance.
3) Develop an understanding of goods transport operations, from vehicle setups to scheduling and cost fixation.
4) Maintain and analyze transport records and documents, ensuring regulatory compliance and performance monitoring.
5) Implement Kaizen principles to enhance the efficiency and quality of transport operations.
6) Consider geographical, social, and economic factors when making decisions related to transport management, and evaluate the impact of these factors on the industry's growth.

Syllabus

Unit 1: Bus transport organization :- **(10 Hrs)**

- Classification road.Water and air transport, their advantages and disadvantages.
- Passenger transport organization set up (MSRTC &private) urban and rural transport.
- Theory of fares- flat fares and telescopic fares.Scheduling of bus transport operation(M.S.R.T.C) and crewing.
- Co-ordination between different department and maintenance department.Calculation of cost of transport.
- Various factors such as geographical, social, economical factor of bus transport operation. Layout of bus station, bus depot.

Unit 1: Goods transport operation :- **(10 Hrs)**

- Basic elements to transport- the way/ the vehicle.Terminals infrastructural facilities.
- Various factors such as geographical, economical, social.
- Goods transport organization - set up (for 1-vehicle, 10-vehicle, 100-vehicle) fixation of cost of transport fixed cost and running cost. Various types of booking- to pay, paid billing.
- Factors to be consider for scheduling of goods transport. Transport and storage of petroleum product.

Unit 1: Transport operation : - **(10 Hrs)**

- Various records, log book.Trip operation sheet, truck history record.Monthly operational performance statement.
- Goods consignment note.Daily fuel consumption. Complaint book room map.
- Use of computer in maintaining the various records. Control of traffic, speed limit.Various important fitness certificate.

References:-

1. Automobile Engg by K.M. Gupta vol II
2. Motor vehicle act 1988
3. Elements of Transport by R. J. Eatan
4. Economics of transport by H. R. Bonavia
5. Transport in modern India by K.P.Bhatnagar, Satish Bhatnagar, S.C.Gupta.

AT-515: B1:- AUTOMOTIVE REFRIGERATION AND AIR CONDITIONING-I

Total Credits : 2	Teaching Time / Week: (2 /Week)
Marks: 50 (10 CA + 40 UA)	

Course Description:

The course, "Automotive Refrigeration and Air Conditioning - 1," provides an in-depth exploration of the principles, components, and systems that underlie automotive air conditioning and refrigeration. It aims to equip students with a comprehensive understanding of these systems, from their environmental and safety considerations to the design and maintenance aspects. The course content is divided into four units, covering fundamental concepts, automotive cooling and heating systems, air conditioning controls, delivery systems, and refrigerants, and air distribution systems.

Course Objectives:

1. To Learn and Understand Refrigeration Fundamentals.
2. To Learn and Understand Refrigerant Selection.
3. To Learn and Understand Human Comfort Conditions.
4. To Learn and Understand Design Considerations.
5. To Learn and Understand Diagnostics and Troubleshooting.

Course Outcomes:

Upon completing this course, students will achieve the following:

1. Will have a solid grasp of the fundamental concepts of automotive air conditioning and refrigeration.
2. Will understand the construction and operation of cooling and heating systems in vehicles, including the different components and technologies used.
3. Will be familiar with control devices, delivery systems, and refrigerants used in automotive air conditioning systems.
4. Will comprehend automatic temperature control and servicing, enabling them to optimize air conditioning systems.

Syllabus

Unit 1: Automotive Cooling And Heating System (10 Hrs)

- Fixed thermostatic and Orifice tube system - Variable displacement thermostatic and Orifice tube systemTypes of compressor
- Compressor Clutches - Compressor Clutch electrical circuit - Compressor lubrication- Condensers - Evaporators -
- Expansion devices - Evaporator temperature and pressure controls -
- receiver - drier - Accumulators - refrigerant hoses, Connections and other assemblies- Heating system.

Unit 2: Air-Conditioing Controls, Delivery System And Refrigerants (10 Hrs)

- Types of Control devices - Preventing Compressor damage - Preventing damage to other systems -
- Maintaining driveability - Preventing Overheating Ram air ventilation - Air delivery Components - Control devices -
- Vacuum Controls Containers - Handling refrigerants - Discharging, Charging & Leak detection - Refrigeration system diagnosis
- Diagnostic procedure - Ambient conditions affecting system pressures.

Unit 3: Air Distribution System (10 Hrs)

- Comfort conditions, Air management and heater systems,
- air distribution modes (Fresh/Recirculation, Face, Foot, Defrost, and Demist), A/C ducts and air filters.
- Blower fans, Temperature control systems (manual/semiautomatic, automatic).
- Vehicle operation modes and Cool-down performance.

Text Books:

1. Warren Farnell and James D.Halderman, "Automotive Heating, Ventilation, and Air Conditioning systems", Classroom Manual, Pearson Prentice Hall, 2004.
2. Steven Daly: "Automotive air conditioning and Climate control systems" Butterworth-Heinemann publications

Reference Books:

1. Roy J Dossat: "Principles of Refrigeration"; Pearson Education Inc.
2. William H Crouse and Donald L Anglin: "Automotive air conditioning"
3. Arora and Damkondwar "Refrigeration and Air Conditioning";: Dhanpatrai and Company.
4. C. P. Arora: "Refrigeration and Air Conditioning", Tata McGraw Hills Pub.
5. Paul Weissler: "Automotive air conditioning" Reston Publishing Co. Inc.

AT-516: A2:- SPECIAL PURPOSE VEHICLE

Total Credits : 2	Teaching Time / Week: (2 /Week)
Marks: 50 (10 CA + 40 UA)	

Course Description:

The "Special Purpose Vehicle" course provides an in-depth understanding of various off-road vehicles, with a specific focus on earthmoving machines and tractors used in construction and other applications. Students will learn about the classification, applications, and components of off-road vehicles, including bulldozers, scrapers, loaders, and more. The course covers essential aspects of these vehicles, such as power plants, chassis, and transmissions. Additionally, it delves into the features and specifications of tractors, highlighting their various types and uses. Students will also gain knowledge about special-purpose vehicles used in military and combat scenarios.

Course Objectives:

1. Develop knowledge about different types of off-road vehicles.
2. Understand the functioning of earthmoving machines, including bulldozers and scrapers.
3. Gain insights into the construction and applications of tractors.
4. Explore specialized equipment used in military and combat operations.
5. Learn about the application of hydraulic and pneumatic circuits in off-road vehicles.

Course Outcomes:

1. Acquire knowledge about the practical use of hydraulic and pneumatic circuits in off-road vehicles.
2. Identify and understand the key features of earthmoving machines, tractors, and specialized vehicles.
3. Recognize the applications and capabilities of various construction and off-road equipment.
4. Analyze the mobility and performance of off-road vehicles.
5. Demonstrate an understanding of soil-vehicle mechanics and traction on different terrains.
6. Develop the ability to assess the suitability and efficiency of special-purpose vehicles for various tasks.

Syllabus

Unit 1: Classification and Requirements of Off Road Vehicles (6Hrs)

- Introduction, pretest, history and overview of an off-road machines,
- Construction layout, capacity and applications,
- Power plants, chassis and transmission, multi-axle vehicles.

Unit 2: Earth Moving Machines and Tractors (8Hrs)

- Bulldozers, cable and hydraulic dozers. Crawler track, running and steering gears,
- Scrapers, drag and self-powered types - dump trucks and dumpers - loaders, single bucket,
- Multi bucket and rotary types - power and capacity of earth moving machines.
- Tractors: General description, specification and functions,

Unit 3: Scrappers, Graders, Shovels and Ditchers (8Hrs)

- Scrappers, elevating graders, Motor graders, Self-powered scrappers and graders,
- Power shovel, Revolving and stripper shovels,
- Drag lines, Ditchers, Capacity of shovels.

Unit 5: Vehicle Systems and Features (8Hrs)

- Brake system and actuation – ocdb and dry disc caliper brakes. Body hoist and bucket operational hydraulics.
- Hydro-pneumatic suspension cylinders. Power steering system. Kinematics for loader and bulldozer operational linkages.
- Safety features, safe warning system for dumper. Design aspects on dumper body, Loader bucket and water tank of sprinkler.

Reference Books:

1. Sharma, S. C. ,"Construction Equipment and its Management"
2. Nakra C.P., "Farm Machines and Equipments", Dhanpatrai Publishing company Pvt. Ltd. 2003
3. Wong J Y, John Wiley and Sons, "Theory of Ground Vehicles", New York, 1978
4. Satyanarayana. B., "Construction Planning and Equipment" standard publishers and distributors, New Delhi.

AT-516: B2:- AUTOMOBILE MANUFACTURING PROCESS - I

Total Credits : 2	Teaching Time / Week: (2 /Week)
Marks: 50 (10 CA + 40 UA)	

Course Description :

"Automobile Manufacturing Process - I" offers an in-depth exploration of the fundamental methods and technologies used in the automotive manufacturing industry. Students delve into the intricate processes behind automobile production, including design, material selection, and assembly. This course equips students with essential knowledge and practical skills, enabling them to comprehend the core stages of manufacturing, from metalworking to quality control. By the end of the course, students are well-versed in the principles of automobile manufacturing and prepared to contribute effectively in the automotive production sector.

Course Objectives:

1. To introduce students to fundamental concepts and techniques in various manufacturing processes .
2. To provide an in-depth understanding of forging, press operations, welding processes, and surface treatment methods .
3. To familiarize students with CNC machining and programming, which are essential skills in the automotive sector.
4. To develop problem-solving skills and the ability to make informed decisions related to manufacturing and machining processes.
5. To instill safety consciousness and environmental considerations in manufacturing practices in alignment with industry standards.

Course Outcomes:

Upon successful completion of this course, students should be able to:

1. Understand the principles and applications of various manufacturing processes used in the automobile industry.
2. Differentiate between traditional and advanced welding processes .
3. Apply knowledge of forging, press operations, and surface treatment methods to enhance the quality and durability .
4. Demonstrate proficiency in CNC programming and machining for precise and efficient manufacturing.
5. Evaluate and optimize manufacturing processes to meet industry standards and safety regulations.

Syllabus

Unit 1: Forging Process **(12 Hrs)**

- Introduction to Forging, Types of Forging Processes, Hot Forging vs. Cold Forging
- Forging Materials and Equipment, Forging Operations and Techniques, Die Design and Die Materials
- Forging Defects and Quality Control, Applications of Forging in Industry, Advancements in Forging Technology
- Forging Safety and Environmental Considerations

Unit 2: Press and Press Operations **(10 Hrs)**

- Introduction to Presses and Press Work, Types of Presses and Their Applications, Press Components and Safety Measures
- Press Tooling and Die Sets, Press Operation Techniques, Stamping and Blanking Operations
- Forming and Bending Processes, Deep Drawing and Hydroforming , Progressive and Transfer Dies
- Press Automation and Control Systems

Unit 3: Traditional Welding Processes **(8 Hrs)**

- Introduction to Welding and Joining Techniques, Types of Traditional Welding Processes: Arc and Gas Welding
- Resistance Welding and Other Traditional Methods
- Welding Equipment and Safety Precautions
- Arc welding, Gas welding

Reference Books:

1) "Manufacturing Processes for Engineering Materials" by Serope Kalpakjian and Steven R. Schmid.
2) "Welding: Principles and Applications" by Larry F. Jeffus.
3) "CNC Machining Handbook: Building, Programming, and Implementation" by Alan Overby.
4) "Surface Treatment and Finishing of Aluminium and Its Alloys" by Wernick, Pinner, and Sheasby.
5) "Introduction to Manufacturing Processes" by Mikell P. Groover.
6) "Fundamentals of Modern Manufacturing: Materials, Processes, and Systems" by Mikell P. Groover.

AT-525: Practical Based on AT 515

Total Credits : 1.5	Teaching Time / Week: (3 /Week)
Marks: 50 (10 CA + 40 UA)	

AT-515: A1:- TRANSPORT MANAGEMENT – I

1. Study of and Classifying Different Road, Water, and Air Transport Modes (Advantages & Disadvantages)
2. Study of and Setting Up a Simulated Passenger Transport System (Scheduling, Fares, Maintenance)
3. Study of and Calculating Fixed and Running Costs for Goods Transport Operations
4. Study of and Designing a Layout for a Bus Station or Depot Emphasizing Efficiency
5. Study of and Maintaining Sample Transport Records (Trip Sheets, Performance Statements)
6. Study of and Implementing a Goods Consignment Note (Real-World Example or Simulation)
7. Study of and Analyzing Daily Fuel Consumption Data in Transport Operations
8. Study of and Identifying Important Transport-Related Fitness Certificates (Research & Presentation)
9. Study of Kaizen Principles to Improve Efficiency in a Transport Scenario (Case Study)
10. Study of and Discussing the Impact of Geographical, Social, and Economic Factors on Transport Management (Group Discussion)

AT-515: B1:- AUTOMOTIVE REFRIGERATION AND AIR CONDITIONING-I

1. Study of and Analyzing Environmental Concerns of Automotive Air Conditioning Systems (e.g., Ozone Depletion)
2. Study of and Identifying Automotive Air Conditioning System Components through
3. Study of and Using a Psychrometric Chart to Solve Air Conditioning System-Related Problems
4. Study of and Comparing Fixed vs. Variable Displacement Thermostatic and Orifice Tube Systems
5. Study of Compressor Operation and Clutch Function in an Air Conditioning System
6. Study of and Diagnostic Procedure for a Simulated Automotive Air Conditioning System Malfunction
7. Study of Different Air Conditioning Control Devices and their Functions
8. Study of Safe Refrigerant Handling Procedures (Discharging, Charging, Leak Detection)
9. Study of and Designing an Air Distribution System Model (Considering Modes and Components)
10. Study of and Evaluating Automatic Temperature Control Systems in Automotive Air Conditioning

AT-526: Practical Based on AT 516

Total Credits : 1.5	Teaching Time / Week: (3 /Week)
Marks: 50 (10 CA + 40 UA)	

AT-516: A2:- SPECIAL PURPOSE VEHICLE

1. Study of and Classifying Different Off-Road Vehicles
2. Study of and Analyzing the Powertrain (Engine, Transmission, Chassis) of a Bulldozer
3. Study of and Comparing Cable vs. Hydraulic Dozer Operation.
4. Study of and Calculating Performance Metrics (e.g., Power, Capacity) for Earthmoving Machines (Scraper, Loader)
5. Study of and Identifying Different Tractor Types (Wheeled, Crawler) and their Applications
6. Study of the Operation of a Hydraulic System in an Off-Road Vehicle (e.g., Loader Arm Movement)
7. Study of and Designing a Simple Farm Implement Attachment (Sketch and Functionality Explanation)
8. Study of Special Features of Military Vehicles (e.g., Tank, Armoured Personnel Carrier)
9. Study of and Testing Brake Systems (Disc Brakes) used in Off-Road Vehicles
10. Study of and Calculating Soil-Vehicle Mechanics Parameters (Mobility Index, Traction Performance)

AT-516: B2:- AUTOMOBILE MANUFACTURING PROCESS – I

1. Study of Different Forging Processes (Open-Die Forging, Upset Forging, etc.)
2. Study of and Comparing Hot Forging vs. Cold Forging on Material Properties
3. Study of a Simple Forging Die (Considering Material and Shape)
4. Study of and Analyzing Press Brake Operations for Sheet Metal Forming
5. Study of and Differentiating Between Stamping and Blanking Operations in a Press
6. Study of and Simulating a Spot Welding Process (GMAW or Arc Spot Welding)
7. Oxy-Fuel Gas Welding Practice on Samples (Following Safety Guidelines)
8. Study of and Selecting the Right Welding Process (Traditional vs. Advanced) for a Specific Automotive Joint.
9. Study of and Writing a Safety Report on Hazards and Precautions in Press Operations
10. Field Visit to an Automobile Manufacturing Unit (if possible) or Virtual Tour with a Focus on Manufacturing Processes (Report on Observations)

AT-517: SEC (E) Leadership Skills

Total Credits : 2	Teaching Time / Week : (2 /Week)
Marks: 50 CA	

Objective:

- Understanding Leadership
- Risk Analysis Skills
- Learning from Success Stories
- Learn Stress Management Techniques
- Learn Client Relationship Building

Outcome:

- Ability to define leadership, identify types, traits, functions, and styles of leadership.
- Proficiency in estimating and managing risks through break-even point analysis.
- Understanding innovation and its impact on productivity and profitability through real-world examples.
- Mastery in stress management methods, including identifying types of stress and improving workplace stress.
- Proficiency in managing client relationships, understanding client requirements, and adopting a customer-centric approach.

Syllabus

Unit I Leadership (5 Hrs)

Define leadership, types of leadership, leadership Traits, Functions of leadership, styles of leadership. Resolving Individual differences among people.

Unit II : Risk Analysis tools (7 Hrs)

Estimate the risks that you could face in your role. In turn, this helps you manage these risks and minimize their impact on your plans. Break-even point analysis. Risk Value = Probability of Event x Cost of Event.

Unit III Success stories / Best Practices – (10 Hrs)

Inspection, inspect Demo displacement. Innovation has become one of the most popular buzz words of the Digital Age. Re-evaluate the true meaning of a concept than when it is being touted by individuals and companies around the world. Spark innovation, maximize productivity, and increase profitability as a result of implementing the Big Five behaviors.

Unit IV : Stress management – (8 Hrs)

Define Management, Type of stress Management, How to improve stress in workplace, Team leader in workplace. Manage relationships with client who may be confused with the services requirements. Build healthy client relationships and use customer centric approach

Text Books & references book

1. "Leadership Sutra: An Indian Approach to Power" by Devdutt Pattanaik - for Unit I: Leadership.
2. "Risk Management: The Indian Context" by Uma Sekaran - for Unit II: Risk Analysis Tools.

3. "The Innovation Sandbox: Building and Testing Products for India" by Ravi Venkatesan - for Unit III: Success Stories / Best Practices.
4. "Stress Management: A Holistic Approach" by Dr. S. K. Sharma - for Unit IV: Stress Management.

AT-517: SEC (F) Entrepreneurship Skills

Total Credits : 2	Teaching Time / Week : (2 /Week)
Marks: 50 CA	

Objective:

Understanding Entrepreneurship

Studying Competitive Advantage

Handling Sensitive Workplace Issues

Learning Marketing Tools

Understanding Market Strategy in Trade Theory

Outcome:

Ability to define entrepreneurship and implement self-employment strategies.

Mastery in analyzing PEST factors and implementing VRIO resources for competitive advantage.

Proficiency in defining and managing sensitive issues through policy development and communication.

Understanding the 7 Ps of marketing and their importance in market strategy.

Ability to utilize market strategy tools in labor market information for effective trade theory implementation.

Syllabus

Unit I Self Employment as a Career path (5 Hrs)

Define Entrepreneurship, Strategy of entrepreneurship, Market Research. Implementation of self Employment in workplace Ps, Mange self-employment in workplace. Quality consciousness – its relevance.

Unit II Study of Competitive Advantage Model. (10 Hrs)

PEST factors for external changes and implement VRIO resources for getting an edge over the competitors.

Ensure that environmental conditions are suitable for the client and the services to be carried. Deal with clients lacking the technical background to solve the problem on their own. Immediate or temporary solutions to resolve delays.

Unit III Strategies of handling sensitive issues: (10 Hrs)

(political, commercial, environmental, cultural, and so on) at workplace 1. Define the issues, 2. Develop Policies Adhering to Company Goals, 3. Communicate Policies, 4. Hold People Accountable and 5. Continue to Evolve.

Unit IV Marketing (5 Hrs)

Tools of marketing, 7 Ps define market strategy, important of market strategy, use of strategy in trade theory (Labour Market Information).

Text Books & References Books

1. "Entrepreneurship Development and Small Business Enterprises" by Poornima M. Charantimath - This book covers topics related to entrepreneurship, market research, and self-employment strategies.

2. "Competitive Advantage: Creating and Sustaining Superior Performance" by Jay B. Barney - While not authored by an Indian author, this book covers the concept of competitive advantage, including PEST analysis and VRIO framework
3. "Strategic Management: Text and Cases" by Azhar Kazmi - This book provides insights into handling sensitive issues in the workplace and developing strategies adhering to company goals
4. "Marketing Management: Text and Cases" by Rajan Saxena - This book covers various tools of marketing, the 7 Ps of marketing, and the importance of market strategy

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Semester VI

AT-611:A1:- AUTOMOBILE AUTOMATION IN MANUFACTURING

Total Credits : 2	Teaching Time / Week: (2 /Week)
Marks: 50 (10 CA + 40 UA)	

Course Description:

IT is a course that delves into the principles and strategies of automation within production systems. It covers a broad range of topics, from the fundamentals of automation and its various levels to material handling, assembly lines, and automated production systems. The course explores both manual and automated assembly processes, providing students with a comprehensive understanding of the role of automation in modern manufacturing.

Course Objectives:

1. To introduce students to the fundamental principles of automation in manufacturing.
2. To provide insights into material handling systems.
3. To familiarize students with manual assembly lines, alternative assembly systems, and the design considerations.
4. To explore transfer lines, storage buffers, and their applications in automated production lines.
5. To introduce students to automated assembly systems, their design, and the quantitative analysis of assembly systems.

Course Outcomes:

Upon completion of this course, students will be able to:

1. Explain the principles and strategies of automation in manufacturing, and analyze the various levels of automation.
2. Evaluate and design material handling systems, including material transport and storage, in manufacturing environments.
3. Design and optimize manual assembly lines, taking into consideration line balancing and efficiency.
4. Analyze transfer lines with and without internal storage to enhance production line performance.
5. Apply automation concepts and techniques to real-world manufacturing scenarios.

Syllabus

Unit 1: Introduction to Automation: **(6 Hrs)**

Automation in Production Systems-Automated Manufacturing Systems, Computerized Manufacturing Support Systems, Reasons for Automation, Automation Principles and Strategies. Manufacturing operations, Production Concepts and Mathematical Models. Costs of Manufacturing Operations, Basic Elements of an Automated Systems, Advanced Automation Functions, Levels of automation.

Unit 2: Introduction to Material Handling: **(12 Hrs)**

Overview of Material Handling Equipment, Considerations in Material Handling System Design, the 10 Principles of Material Handling. Material Transport Systems, Automated Guided Vehicle Systems, Monorails and other Rail Guided Vehicles, Conveyor Systems, Analysis of Material Transport Systems. Storage Systems, Storage System Performance, Storage Location Strategies, Conventional Storage Methods and Equipment, Automated Storage Systems, Engineering Analysis of Storage Systems. Automatic data capture-overview of Automatic identification methods, bar code technology, other ADC technologies.

Unit 3: Manual Assembly Lines - **(6 Hrs)**

Fundamentals of Manual Assembly Lines, Alternative Assembly Systems, Design for Assembly, Analysis of Single Model Assembly Lines, Line balancing problem, largest candidate rule, Kil bridge and Wester method, and Ranked Positional Weights Method, Mixed Model Assembly Lines, Considerations in assembly line design.

Unit 4: Transfer lines, **(6 Hrs)**

Fundamentals of Automated Production Lines, Storage Buffers, and Applications of Automated Production Lines. Analysis of Transfer Lines with no Internal Storage, Analysis of Transfer lines with Storage Buffers.

Textbook:

1. "Automation, Production Systems and Computer Integrated Manufacturing" by Mikell P. Groover, Pearson Education.

Reference Books:

1. "CAD CAM: Principles, Practice and Manufacturing Management" by Chris Mc Mohan, Jimmie Browne, Pearson Education
2. "Automation" by Buckingham W, Harper & Row Publishers, New York, 1961.
3. "Automation for Productivity" by Luke H.D, John Wiley & Sons, New York, 1972.

AT-611:B1:- EV CHARGING STATION DESIGN -II

Total Credits : 2	Teaching Time / Week: (2 /Week)
Marks: 50 (10 CA + 40 UA)	

Course Description:

EV Charging Station Design - 2 is an advanced course that builds upon the fundamentals of EV charging station design. This course focuses on the selection and sizing of connectors, applications, and various types of chargers, including AC and DC chargers. It covers communication protocols between chargers and electric vehicles, international standards, and specifications. Additionally, the course explores the design of public charging infrastructure, electrical systems, distribution transformers, cables, and substations. It also discusses the integration of EV chargers with solar power plants.

Course Objectives:

1. To equip students with the knowledge and skills to select and size common types of connectors for AC and DC chargers.
2. To understand communication protocols between chargers and electric vehicles.
3. To introduce international standards and specifications for charging topology and connectors.
4. To teach the design of public charging infrastructure, including site assessment and equipment selection.
5. To explore the integration of EV chargers with solar power plants, including PV module technology and inverter selection.

Course Outcomes:

Upon completion of this course, students will be able to:

1. Select and size connectors for various types of EV chargers, ensuring compatibility and efficient communication.
2. Apply international standards and specifications to ensure safe and reliable charging infrastructure.
3. Design public charging infrastructure, considering site location, transformers, cables, and distribution boards.
4. Calculate and specify the sizing of cables and equipment for the electrical system.
5. Integrate EV chargers with solar power plants, selecting appropriate PV module technology and inverters.
6. Develop single-line diagrams and electrical plans for EV charging stations integrated with solar power.

Syllabus

Unit 1:. Selection and sizing of Common types of connectors and applications (6 Hrs)

- Selection of AC charger type-1 , type -2 and type -3,
- Communication between AC charger and EV
- Selection of DC charger connector GB/T, CHAdeMO , CCS-1 and CSS-2
- Communication methodology of DC fast chargers
- IS/ IEC/ARAI/ standard of Charging topology ,
- Communication and connectors (IEC 61851-1, IEC 61851-24,62196-2)
- Selection sizing of Charger connector cable

Unit 2: - Public Charging infrastructure / Electrical system design (12 Hrs)

- Assessment of site Location for Public charging station
- Selection and Sizing of Distribution transformer
- Selection and sizing of HT Equipment (VCB , CT , PT , Metering)
- Selection and Sizing HT Cables and LT cables
- Selection and sizing of Distribution Board / feeders
- Sizing calculation of LT and HT cable
- Selection and of Compact Substation (CSS for EV CS)/ Power Sub station)
- Selection of relay and calculation
- Preparation of EV Charger Single Line Diagram
- Preparation of EV Charger Electric
- Assessment of site Location for Public charging station
- Selection and Sizing of Distribution transformer
- Selection and sizing of HT Equipment (VCB , CT , PT , Metering)
- Selection and Sizing HT Cables and LT cables
- Selection and sizing of Distribution Board / feeders
- Sizing calculation of LT and HT cable
- Selection and of Compact Substation (CSS for EV CS)/ Power Sub station)

- Selection of relay and calculation
- Preparation of EV Charger Single Line Diagram
- Preparation of EV Charger Electric

Unit 3: -EV Charger Integration with Solar Power Plant **(12 Hrs)**

- Selection of PV module technology
- Crystalline technology
- Thin film technology
- Bi-facial technology
- Comparison between PV module technology
- Comparison between solar power plant energy out put
- Types of solar inverter
- Selection of string /central / off grid inverter
- Selection of power conditioning unit (PCU)
- Sizing of solar inverter for roof top and grid connected projects
- Selection and sizing of string inverter
- Selection and sizing of central inverter
- AC/DC overloading calculation and losses
- Protection requirement of solar inverter
- Passive and active protection
- Preparation of rooftop solar power (single line diagram) SLD
- Preparation of Net Metering solar power (single line diagram) SLD
- Preparation utility scale solar power (Ground mounted) SLD
- Rooftop solar power plant layout
- Ground mounted solar power plant layout
- DC SLD /AC SLD
- Protection SLD
- Earthing Layout/ AC /DC cabling Layout
- DC Block sizing layout
- Overall Array Plant Layout

Reference Books:

1. "Electric Vehicle Technology Explained" by James Larminie and John Lowry
2. "Electric Vehicle Charging Infrastructure" by S.M. Islam, K.T. Chau, and S. Kar
3. "Solar Photovoltaic Technology and Systems: A Manual for Technicians, Trainers, and Engineers" by Chetan Singh Solanki

AT-612:A1:- MECHATRONICS-II

Total Credits : 2	Teaching Time / Week: (2 /Week)
Marks: 50 (10 CA + 40 UA)	

Course Description:

Mechatronics-II is an advanced course that builds on the principles of Mechatronics, combining mechanical engineering, electronics, and computer science. This course covers essential topics related to sensors, transducers, electrical actuation systems, microprocessors, microcontrollers, and motor control relays. It aims to equip students with a deep understanding of Mechatronics systems and their applications in various industries.

Course Objectives:

1. To introduce the concept of Mechatronics and its role in modern engineering systems.
2. To explore various sensors and transducers used for measuring physical quantities.
3. To provide insights into electrical actuation systems, including switches, solenoids, and motors.
4. To familiarize students with microprocessors and microcontrollers, their architecture, and applications.
5. To enable students to understand motor control relays, interfacing sensors, and display devices in Mechatronics systems.

Course Outcomes:

Upon completion of this course, students will be able to:

1. Define Mechatronics and identify its components, including measurement and control systems.
2. Analyze different sensors and transducers and their performance parameters.
3. Understand electrical actuation systems and their applications in Mechatronics devices.
4. Comprehend the architecture and features of microprocessors and microcontrollers.
5. Demonstrate practical skills in motor control, sensor interfacing, and display device integration.
6. Apply Mechatronics principles to real-world engineering problems and projects.

Syllabus

Unit 1: Introduction to 8085 Microprocessor **(6 Hrs)**

- Introduction , Features of 8085 Microprocessor
- Architecture of 8085 **a)** Registers **b)** ALU
- **c)** Address Buffers) Address / Data Buffer) **d)**Interrupt control
- **f)** Timing & control circuitry , **g)** Pin connection of 8085

Unit 2: The 8051 microcontrollers **(5 Hrs)**

- Block Diagram , Over View of 8051 microcontrollers family
- Connection of 8051 Microcontrollers, Input output port

Unit 3: Sensors and transducers **(8 Hrs)**

- Introduction Sensors and transducers.
- Temperature Sensor, Light Sensor, Selection of sensor.
- Performance terminology.
- Displacement, position and proximity.
- Velocity and motion. Force, Fluid Pressure ,Liquid Flow , Liquid Level.

Unit 4: Electrical actuation systems **(6 Hrs)**

- Electrical systems.Mechanical switches, Solid- state switches.
- Solenoids, D.C.motors, A.C. Motors, Stepper motors.

Unit 5: Motor control Relay **(5 Hrs)**

- LCD Display , LED Seven segment display
- Interfacing of Sensors
- Controller and display device

Reference Books

1. "Microprocessor Technique" - By Atul P. Godse&Deepali A Godse
2. "Mechatronics" - By W.Bolten
3. "The 8051 Micro controller Embedded System" - By M.A. Mazidi

AT-612:B1:- ROBOTICS-II

Total Credits : 2	Teaching Time / Week: (2 /Week)
Marks: 50 (10 CA + 40 UA)	

Course Description:

Robotics-II is an advanced course that delves into the world of robotics, focusing on topics such as robot sensors, vision systems, programming languages, and their practical applications in various industries. This course provides students with an in-depth understanding of the technologies that make robots intelligent, capable of sensing their surroundings, and performing tasks in industrial settings.

Course Objectives:

1. To introduce the importance of sensors in robotics and understand their role in robot perception and interaction with the environment.
2. To explore various types of sensors used in robotics and their working principles.
3. To discuss the need for vision systems in robotics, including image acquisition, illumination techniques, and image conversion.
4. To introduce students to robot programming languages and methods for controlling robotic systems.
5. To provide insights into the industrial applications of robots, including material transfer, welding, assembly, and inspection.

Course Outcomes:

Upon completion of this course, students will be able to:

1. Explain the significance of sensors in robotics and their relevance to real-world applications.
2. Identify and classify different types of sensors based on their working principles.
3. Demonstrate an understanding of robot vision systems, including image acquisition and processing.
4. Comprehend the basics of robot programming languages and how artificial intelligence plays a role in robot control.
5. Analyze and evaluate the use of robots in various industrial applications, such as material handling, welding, and assembly.

Syllabus

Unit 1:-Robot Sensor **(12 Hrs)**

- Types of sensor based on working principal.
- Type of sensor- Range sensor, Proximity sensor, Touch sensor.Need of sensor in robotic system.
- Various sensing device used in robot.Work cell.
- Sensor characteristics.Selection of sensor& uses in Robotics

Unit 1:-Robot Vision System **(6 Hrs)**

- Need of vision system in robotics.Image acquisition.
- Illumination technique.Image conversion.Camera sensor.

Unit 1:-Robot Programming Language **(6 Hrs)**

- Methods of Robot programming.Robot programming language.
- Artificial intelligence's in robot.

Unit 1:- Robot Application in Manufacturing **(6 Hrs)**

- General consideration in robot material handling.Material transfer application.
- Machine loading and unloading.Spot Welding & Continuous Arc Welding.
- Spray Coating.Assembly& Inspection

Reference Books:

1. "Industrial Robotics: Technology, Programming, and Applications" by M.P. Groover, M. Weiss, R.N. Nagel, N.G. Odrey
2. "Robotics Technology and Flexible Automation" by S.R. Deb
3. "Robotics: Control, Sensing, Vision, and Intelligence" by K.S. Fu, R.C. Gonzalez, and C.S.G. Lee

AT-621: Practical Based on AT 611

Total Credits : 1.5	Teaching Time / Week: (3 /Week)
Marks: 50 (10 CA + 40 UA)	

AT-611:A1:- AUTOMOBILE AUTOMATION IN MANUFACTURING

1. Study of and Analyzing the Reasons for Automation in Modern Production Systems (Cost Analysis, Efficiency Improvement)
2. Study of and Designing a Material Handling System with Different Equipment Options (e.g., Conveyor Belts, Robots)
3. Study of a Manual Assembly Line for a Simple Product
4. Study of Performance Metrics (Throughput Time, Utilization) for a Transfer Line with Storage Buffers
5. Study of and Designing an Automated Assembly Workstation for a Specific Automotive Part (e.g., Door Panel)
6. Study of and Comparing Different Levels of Automation (Fixed, Programmable, Flexible) in Manufacturing Scenarios
7. Study of Automatic Data Capture Methods (Barcodes, RFID) in Material Tracking (Software Simulation)
8. Study of and Analyzing Design for Assembly (DFA) Principles to Improve Manufacturability of an Automotive Component
9. Field Visit to an Automated Manufacturing Facility (if possible) or Virtual Tour with a Focus on Automation Techniques
10. Study of a Cost-Benefit Analysis of Implementing Automation in a Specific Automotive Manufacturing Process

AT-611:B1:- EV CHARGING STATION DESIGN -II

1. Explore different types of solar inverters (string, central, off-grid) used in EV charging station solar integration projects.
2. Analyze the characteristics and applications of different photovoltaic (PV) module technologies (crystalline, thin-film, bifacial).
3. Practice creating single-line diagrams for EV charging stations using industry-standard symbols and conventions.
4. Explore the concept of compact substations (CSS) for EV charging infrastructure and analyze their advantages over traditional substations.
5. To Study design a basic electrical system layout for an EV charging station, including HT & LT cables, distribution boards, and metering equipment.
6. To Study to select appropriate distribution transformer size for a public charging station based on expected load demand.
7. Research and present on international standards and specifications set by organizations like IEC and ARAI for charging topology, connectors, and safety aspects.
8. Explore different DC fast charger connector standards (GB/T, CHAdeMO, CCS) and their functionalities
9. Utilize simulation software or online resources to demonstrate the communication protocols (e.g., IEC 61851-1) used between AC chargers and EVs.
10. Analyze different AC charger connector types (Type 1, Type 2, Type 3) based on international standards (IEC 61851).

AT-622: Practical Based on AT 512

Total Credits : 1.5	Teaching Time / Week: (3 /Week)
Marks: 50 (10 CA + 40 UA)	

AT-612:A2:- MECHATRONICS-II

1. Measurement of Displacement Using LVDT
2. Measurement of Distance Using LDR
3. Measurement of Temperature Using RTD
4. Measurement of Temperature Using Thermocouple
5. Measurement of Weight Using Strain Gauge
6. Measurement of Temperature Using Thermister
7. Measurement of Pressure Using Piezoelectric Pick Up
8. Measurement of Speed of D.C. Motor By Photoelectric Pick Up
9. Study of architecture of Microprocessor 8085
10. Introduction To 8051 Microcontroller

AT-612: B2:- ROBOTICS-II

1. Study of sensor integration.
2. Study of robot vision system
3. Study of Range sensor
4. Study of programming language
5. Study of Image conversion & Camera sensor
6. Study of Artificial intelligence's in robot
7. Study of industrial application of robot
8. Study of Assembly& Inspection
9. Study of Spot Welding & Continuous Arc Welding
10. Study of Spray Coating

AT-613:A1:- AUTOMOBILE TROUBLES MAINTENANCE AND TESTING -II

Total Credits : 2	Teaching Time / Week: (2 /Week)
Marks: 50 (10 CA + 40 UA)	

Course Description:

IT is an advanced course that delves deeper into the diagnosis, maintenance, and testing of critical automotive systems. The course covers clutch and transmission issues, drive line, steering, suspension, brakes, and performance characteristics of vehicles. It prepares students for the intricate aspects of automobile troubleshooting and repair.This course equips students with advanced troubleshooting and repair skills, focusing on critical automotive systems. Students will be capable of diagnosing and addressing complex issues related to clutches, transmissions, drive lines, steering, suspension, and brakes. Additionally, they will gain an understanding of vehicle performance characteristics for efficient and safe driving.

Course Objectives:

1) To enable students to identify and resolve issues related to clutch operation.
2) To teach students how to address issues like vibrations, noise, and other anomalies in the drive line and differential.
3) To provide students with the skills to diagnose steering problems.
4) To educate students on identifying and fixing various brake system problems.
5) To familiarize students with the per-servicing checks, tightening torque limits, and the general approach to servicing and overhauling vehicles, along with common repair instructions.

Course Outcomes:

Upon completing this course, students will be able to:

1) Diagnose and resolve clutch-related problems, including slipping, dragging, and noise, and address gear shifting .
2) Identify and address drive line problems, such as vibrations and noise, and differential-related issues.
3) Diagnose and repair steering problems, such as excessive play and pulling, as well as suspension issues.
4) Identify and address brake system problems, such as pedal issues, dragging, softness, and inefficiency.
5) Understand the essential steps in servicing and overhauling vehicles.
6) Evaluate the performance characteristics of vehicles.

Syllabus

Unit 1:Transmission: - **(12Hrs)**

Clutch slips clutch drag clutch judder clutch rattle clutch petrol pulsating, clutch Noise.Gear Slips, Gear shifting hard, Gear loose produces noise, Sticks in gear, no power transmission, oil leaks.Vibration during running of vehicle, Noise in drive line, noise in differential.Excessive play in steering wheel hard steering car wander, car pulls is one side during normal driving, car pulls to one side during braking, front wheel shimmy. Improper tyre wears.

Unit 2: Suspension &Brake System:- **(8Hrs)**

Hard or rough vide way on turns sagging spring, noise in suspension.Brake pedal goes to floor board, one brake drags, soft or spongy brake, poor brake efficiency, Noisy brake loss of brake fluid power brake troubles.

Unit 3: Servicing, Overhauling: - **(7Hrs)**

Introduction, general awareness before servicing a vehicle, tightening torque Limits of wears & damages requiring repairs. General repair instruction.

Unit 4: Heater & Air Conditioning:- **(3Hrs)**

Little or no heat, blower motor inoperative, too much heat, insufficient Defrosting, Insufficient cooling.

Reference books

6. "Automobile Engineering" by R.K. Rajput
7. "Automobile Engineering VOL-1" by Kirpal Singh
8. "Automobile Engineering VOL-2" by Kripal Singh
9. "Automobile Engineering" by Dr. G. B. S. Narang
10. "Automobile Engineering" by Dr. B.L. Singal

AT-613:B1:- ENGINE EMISSION CONTROL-II

Total Credits : 2	Teaching Time / Week: (2 /Week)
Marks: 50 (10 CA + 40 UA)	

Course Description

The course, "Engine Emission Control - 2," is a continuation of the exploration into alternative fuels and emission control for internal combustion (IC) engines. It focuses on advanced topics related to emission control and the application of various technologies to reduce emissions from both spark-ignition (SI) and compression-ignition (CI) engines. The course aims to deepen students' understanding of emission measurement, norms, and cutting-edge technologies used in the automotive industry to mitigate environmental impact.The course content spans three units, covering advanced topics in emission measurement, emission norms, SI engine emission control technologies, and CI engine emission control technologies.

Course Objectives:

1. To Learn & Understand Advanced Emission Measurement.
2. To Learn & Understand Emission Norms.
3. To Learn & Understand SI Engine Emission Control.
4. To Learn & Understand CI Engine Emission Control.

Course Outcomes:

Upon completing this course, students will achieve the following:

1. Students will be capable of using Advanced Emission Measurement.
2. Students will analyze and interpret Global Emission Norms.
3. Students will understand and apply SI Engine Emission Control Technologies.
4. Will be proficient in employing advanced emission control CI Engine Emission Control Technologies.

Syllabus

Unit 1: Emission Measurement and Emission Norms **(14 Hrs)**

- Emission Measurement: NDIR analyzers, FID, Chemiluminescence NOx analyzer,
- Oxygen analyzer, smoke measurement, constant volume sampling,
- Particulate emission measurement. Emission Norms: European Standards, Bharat Standard and US Standards.
- Light Duty Vehicles, Heavy Duty Vehicle emission Standards and Light Duty Vehicles and motor cycle emission standard.
- EURO VI, Bharat New Vehicle Safety Assessment Program.

Unit 2: SI Engine Emission Control Technologies **(8 Hrs)**

- Engine design parameters, add on systems for treatment of emissions with engine,
- Thermal exhaust after treatment, catalytic exhaust after treatment, types of catalytic convertor.

Unit 3: CI Engine Emission Control Technologies **(8 Hrs)**

- Fuel injection variables, electronic fuel injection system, EGR, turbo charging,
- catalytic exhaust gas after treatment, diesel particulate filters.

Text Book:

1. B. P. Pundir, "Engine Emissions", Narosa Publications, Faculty of Science and Technology Savitribai Phule Pune University, Pune, Syllabus for final Year of Automobile Engineering
2. S. S. Thipse "Alternative Fuels", Jaico publications.
3. E.F. Oberts, "Internal Combustion Engine and Air Pollution", Harper & Row Publisher, NY.
4. M. L. Mathur and R. P. Sharma, "Internal Combustion Engine", Dhanpat Rai Publication.

Reference Books:

1. J.G. Giles, "Vehicle Operation & Testing", (Automotive Vehicle Technology Vol. 7) C.H. Fisher, Carburetion, Vol. 4.
2. A.W. Judge, "Carburetion and Fuel Injection System", Motor Manual, Vol. 2, the Caxton Pub. Co. Ltd., London.
3. G.B.S. Narang, "Automobile Engineering", CBS Publishers & Distributors, Delhi.
4. F. Schafar & R van Basshuysen, "Reduced Emission and Fuel Consumption in Automobile Engine", Springer-Verlag Wien New York.

AT-614:A2:- AUTOMOTIVE SAFETY

Total Credits : 2	Teaching Time / Week: (2 /Week)
Marks: 50 (10 CA + 40 UA)	

Course Description:

The "Automotive Safety" course provides a comprehensive understanding of safety aspects in the automotive industry. It covers the design of vehicles for safety, including concepts like crumple zones and energy equations. Students will explore the dynamics of lateral motion, body roll, and stopping distances. The course also delves into active and passive safety, examining concepts like exterior and interior safety. Safety equipment, such as seat belts, airbags, and electronic systems, is thoroughly studied. Collision warning and avoidance systems, as well as comfort and convenience systems, are also discussed. By the end of this course, students will have an in-depth understanding of automotive safety and the various safety equipment employed in vehicles.

Course Objectives:

1. Familiarize students with automotive safety principles and the design of vehicles for safety.
2. Distinguish between active and passive safety concepts in vehicles.
3. Understand the functioning and importance of restraint systems like seat belts and airbags.
4. Explore collision warning and avoidance systems and their role in reducing fatalities.
5. Gain knowledge about comfort and convenience systems in automobiles.

Course Outcomes:

1. Apply knowledge of automotive safety in vehicle design and analysis.
2. Students understand the basic concepts of body design for safety based on engine location.
3. Students will be able to differentiate the safety systems.
4. Students understand the importance and working of restraint systems like seat belts, airbags, etc.
5. Students understand the importance of collision warning and avoidance system in reducing the fatality.

Syllabus

Unit 1: SAFETY CONCEPTS **(8 Hrs)**

- Active safety: driving safety, conditional safety, perceptibility safety, operating safety,
- passive safety: exterior safety, interior safety, deformation behaviour of vehicle body,
- speed and acceleration characteristics of passenger compartment on impact. Stopping distance.

Unit 2: SAFETY EQUIPMENTS **(8 Hrs)**

- Seat belt, regulations, automatic seat belt tightener system, collapsible steering column, tiltable steering wheel,
- air bags, electronic system for activating air bags, bumper design for safety.Hill Assist, Traction Control,
- Limited Slip Differential (LSD), ACC.

Unit 3: COLLISION WARNING AND AVOIDANCE **(7 Hrs)**

- Collision warning system, causes of rear end collision, frontal object detection, rear vehicle object detection system,
- object detection system with braking system interactions. EBD (Electronic Brake-force Distribution),
- ESP (Electronic Stability Program), EBA (Electronic Brake Assist).

Unit 4: COMFORT AND CONVENIENCE SYSTEM **(7 Hrs)**

- Steering and mirror adjustment,concept of crumble zone, central locking system,
- Garage door opening system, Tyre pressure control system, rain sensor system,
- environment information system Lighting System.Body roll in curves.

TEXT BOOKS:

1. Bosch, "Automotive Handbook", 9th Edition, SAE publication, 2014.
2. Powloski. J., "Vehicle Body Engineering", Business books limited, London, 1969.

REFERENCES:

1. Ulrich Seiffert and Lothar Wech, "Automotive Safety Hand Book", SAE International, 2013.
2. George A. Peters and Barbara J. Peters, "Automotive Vehicle Safety", 1st edition, CRC Press, 2002.
3. Ronald.K.Jurgen, "Automotive Electronics Handbook", Second Edition, McGraw-Hill Inc.1999.

AT-614:B2:- QUALITY ENGINEERING & INDUSTRIAL MANAGEMENT-II

Total Credits : 2	Teaching Time / Week: (2 /Week)
Marks: 50 (10 CA + 40 UA)	

Course Description:

This course builds upon the foundation of quality engineering and industrial management, focusing on Total Quality Management (TQM), customer satisfaction, organizational aspects, and ISO 9000 standards. It provides students with a deeper understanding of these topics and their practical applications in industrial settings.

Course Objectives:

1. To introduce students to the concept of Total Quality Management (TQM) and its relevance to business performance.
2. To emphasize the importance of top management's attitude and involvement in quality initiatives.
3. To explore the principles of customer focus and satisfaction.
4. To introduce students to the concept of benchmarking and its role in improving organizational processes.
5. To cover the organization of TQM, the transition from traditional to TQM-oriented organizations.
6. To provide an understanding of ISO 9000 standards.

Course Outcomes:

Upon completion of this course, students will be able to:

1. Define Total Quality Management (TQM) and explain its significance in improving business performance.
2. Recognize the importance of top management's commitment, communication, and organizational culture .
3. Understand the dynamics of customer focus, satisfaction, and the role of marketing and sales in quality management.
4. Comprehend the concept of benchmarking, its benefits, and the procedures involved.
5. Describe the organization of TQM, the transition process, and the significance of Quality Circles.
6. Apply various tools of TQM, including stratification, check sheets, scatter diagrams, and Ishikawa diagrams.
7. Explain the importance of ISO 9000 standards, standardization techniques, and the benefits of ISO 9000 certification.

Syllabus

Unit 1:Introduction **(8 Hrs)**

The concept of TQM, Quality and Business performance, attitude and involvement of top management, communication, culture and management systems. Management of Process Quality: Definition of quality, Quality Control, a brief history, Product Inspection vs. Process Control, Statistical Quality Control, Control Charts and Acceptance Sampling.

Unit 2:Customer Focus and Satisfaction **(8 Hrs)**

Process Vs. Customer, internal customer conflict, quality focus, Customer Satisfaction, role of Marketing and Sales, Buyer – Supplier relationships. Bench Marking: Evolution of Bench Marking, meaning of bench marking, benefits of bench marketing,the bench marking procedure, pitfalls of bench marketing.

Unit 3:Organizing for TQM **(7 Hrs)**

The systems approach, Organizing for quality implementation, making the transition from a traditional to a TQM organization, Quality Circles, seven Tools of TQM: Stratification, check sheet, Scatter diagram, lshikawa diagram, paneto diagram; Kepner & Tregoe Methodology.

Unit 4: Introduction of ISO 9000 **(7 Hrs)**

Definition of standardization, Techniques for standardization's, Codification system, Variety control, Value engineering. **ISO 9000**: Universal Standards of Quality: ISO around the world, The ISO 9000 ANSI/ASQC Q- 90.Series Standards, benefits of ISO 9000 certification, the third party audit, Documentation ISO9000and services, the cost of certification implementing the system.**07 Hours**

Reference Books

1. Principles of Management Koontz O Donnel McGraw Hill
2. Statistical Quality ControlE.L. Grant and R.S.Leavenworth,7th editionMcGraw Hill
3. Essentials of management Koontz Weirich7th EditionTATA McGraw Hill
4. Management ofOrganizational BehaviorHersey Paul andKenneth H,Prentice Hall ofIndiaPvt. Ltd.
5. Operations management strategyand analysis Lee J.Krajewski and Larry P.RitzmanFifth EditionAddison-Wiley.
6. Organizational Behavior Stephen P Robbins, 9th Edition Pearson Education

AT-623: Practical Based on AT 613

Total Credits : 1.5	Teaching Time / Week: (3 /Week)
Marks: 50 (10 CA + 40 UA)	

AT-613:A1:- AUTOMOBILE TROUBLES MAINTENANCE AND TESTING –II

1. Perform trouble shooting and maintenance practical on clutch.
2. Perform trouble shooting and maintenance practical on heater
3. Perform trouble shooting and maintenance practical on rolling frictional, gradient, air, acceleration, tractive resistance
4. Perform trouble shooting and maintenance practical on grade ability of vehicles
5. Perform trouble shooting and maintenance practical on air conditioning
6. Perform trouble shooting and maintenance practical on suspension system
7. Perform trouble shooting & maintenance practical on differential
8. Trouble shooting & maintenance practical on transmission.
9. Demonstration of steering system by measurement of steering geometry angles &their impact on vehicleperformance
10. Perform trouble shooting in braking system and maintenance.

AT-613:B1:- ENGINE EMISSION CONTROL-II

1. Study of Emission Measurement: NDIR analyzers
2. Study of smoke measurement
3. Study of Emission Norms: European Standards, Bharat Standard and US Standards
4. Study of oxygen analyzer
5. Study of catalytic convertor
6. Study of thermal exhaust after treatment
7. Study of catalytic exhaust after treatment
8. Study of EGR
9. Study of turbo charging
10. Study of diesel particulate filters

AT-624: Practical Based on AT 614

Total Credits : 1.5	Teaching Time / Week: (3 /Week)
Marks: 50 (10 CA + 40 UA)	

AT-614:A2:- AUTOMOTIVE SAFETY

1. Study of concept of crumble zone
2. Study of Active safety, passive safety
3. Study of Seat belt
4. Study of collapsible steering column
5. Study of air bags
6. Study of bumper design for safety
7. Study of Collision warning system
8. Study of EBD, ESP, EBA.
9. Study of tyre pressure control system
10. Study of Steering and mirror adjustment

AT-614:B2:- QUALITY ENGINEERING & INDUSTRIAL MANAGEMENT-II

1. Study of Communication and Culture in TQM through Role-Playing Activity
2. Study of Customer Satisfaction Survey Design through Development and Analysis
3. Study of Benchmarking Practices through a Comparative Exercise
4. Study of Quality Circles through a Problem-Solving Simulation
5. Study of Data Analysis and Control Charts for Process Monitoring
6. Study of Quality Improvement Tools through Application
7. Study of ISO 9000 Benefits through a Case Study Analysis
8. Study of ISO 9000 Auditing Procedures through a Mock Audit
9. Study of Cost-Benefit Analysis for Quality Management Systems through a Financial Evaluation:
10. Study of TQM Implementation Challenges through a Case Study Analysis:

AT-615:A1:- TRANSPORT MANAGEMENT - II

Total Credits : 2	Teaching Time / Week: (2 /Week)
Marks: 50 (10 CA + 40 UA)	

Course Description:

IT is a continuation of the study of the legal, regulatory, and safety aspects of the transportation industry. This course delves into the legal framework governing motor vehicles, traffic rules and regulations, and insurance practices relevant to transport management.This course equips students with the knowledge and skills necessary to navigate the legal and regulatory aspects of motor vehicle operations, ensuring safety and compliance with the law in the transport industry. Students will also gain insight into insurance practices and accident claims relevant to the sector.

Course Objectives:

1) To provide students understanding of the Motor Vehicle Act of 1939 and the Motor Vehicle Act of 1988.
2) To educate students on the legal requirements associated with driving licenses, vehicle registration, ownership transfer, sales, hire purchase, permits, fitness, taxation, and registration marks.
3) To familiarize students with traffic signs, road safety principles.
4) To enable students to understand various traffic offenses and the corresponding penalties.
5) To explore the concept of insurance, types of insurance relevant to the transport industry, and the procedures .

Course Outcomes:

Upon completing this course, students will be able to:

1) Explain the key provisions and regulations outlined in the MV Act of 1939 and the MV Act of 1988.
2) Successfully navigate the legal aspects of driving licenses, vehicle registration, ownership transfer.
3) Recognize and interpret traffic signs and promote road safety measures.
4) Identify traffic offenses and understand the associated penalties, fostering safe driving practices.
5) Differentiate between various types of insurance.
6) Demonstrate a high level of legal awareness in the context of motor vehicle regulations and road safety.

Syllabus

Unit 1: Motor Vehicle Act :- **(11 Hrs)**

- Overview of motor vehicle act 1939. Motor vehicle act 1988.Terms defined in motor vehicle act.
- Driving license. Registration of vehicle .Transfer of ownership. Sales of new vehicle.
- Hire purchase. Cancellation of hire purchase. Permits, fitness. Taxation.
- State transfer of vehicle. Registration mark.

Unit 2: Traffic Signs & Rules:- **(9 Hrs)**

- Organization & duties of traffic control department, Road safety, traffic signs.
- Transport authority & their responsibility. Traffic offence & punishment safe driving skill, Highway codes.

Unit 3: Insurance :- **(10 Hrs)**

- Difference between assurance & insurance, Different types of insurance- life, fire, motor vehicle comprehensive, third party.
- Procedure of accident claim & settlement, Furnishing of particular vehicle involved in accident,
- Duty of driver in case of accident. Surveyor and loss assessor- role function of surveyor,
- Loss assessment of accident vehicle, How to claim & where.

References:-

1. Automobile Engg -by K.M. Gupta vol II
2. Motor vehicle act 1988 Fundamental principles of road passenger
3. Transport operation by F. G.Fletcher Elements of Transport by R. J. Eatan
4. Transport in modern India by K.P.Bhatnagar, Satish Bhatnagar, S.C.Gupta.
5. Motor Transportation by Hudson & constantin
6. Economics of transport by H. R. Bonavia

AT-615:B1:- AUTOMOTIVE REFRIGERATION AND AIR CONDITIONING-II

Total Credits : 2	Teaching Time / Week: (2 /Week)
Marks: 50 (10 CA + 40 UA)	

Course Description:

The course, "Automotive Refrigeration and Air Conditioning - 2," is the continuation of the exploration into automotive air conditioning and refrigeration. Building upon the fundamentals covered in the first part, this course delves into advanced topics such as automatic temperature control, system servicing and testing, diagnostics, troubleshooting, service, and repair.The course content is divided into three units, covering automatic temperature control, system servicing and testing, and diagnostics, troubleshooting, service, and repair.

Course Objectives:

1. To Learn & Understand Automatic Temperature Control.
2. To Learn & Understand System Servicing and Testing.
3. To Learn & Understand Diagnostics, Troubleshooting, Service, and Repair.

Course Outcomes:

Upon completing this course, students will achieve the following:

1. Will have a deeper understanding of automotive air conditioning systems, including automatic temperature control.
2. Will gain practical knowledge of servicing and testing automotive air conditioning components and systems.
3. Will develop expertise in diagnosing and troubleshooting automotive air conditioning problems.

Syllabus

Unit 1: Automatic Temperature Control **(8 Hrs)**

- Different types of sensors and actuators used in automatic temperature control -
- Fixed and variable displacement temperature control -
- Semi Automatic - Controller design for Fixed and variable displacement type air conditioning system.

Unit 2: System Servicing And Testing **(8 Hrs)**

- Special tools for servicing vehicle air conditioning - Diagnosing components and air conditioning systems -
- Diagnosing cooling system - Air delivery system - Automatic temperature Control system diagnosis and service.

Unit 3: Diagnostics, Trouble Shooting, Service & Repair **(14 Hrs)**

- Initial vehicle inspection, temperature measurements, pressure gauge reading & cycle testing,
- leak detection & detectors, Sight glass. Refrigerant safety/handling, refrigerant recovery;
- recycle & charging, system oil, system flushing, odor removal, retrofitting.
- Removing & replacing components, Compressor service.

TEXT BOOKS:

1. Steven Daly: "Automotive air conditioning and Climate control systems" Butterworth-Heinemann publications
2. Warren Farnell and James D.Halderman, "Automotive Heating, Ventilation, and Air Conditioning systems", Classroom Manual, Pearson Prentice Hall, 2004.
3. Warren Farnell and James D.Halderman, "Automotive Heating, Ventilation, and Air Conditioning systems", Shop Manual, Pearson Prentice Hall, 2004.
4. William H Crouse and Donald L Anglin, "Automotive Air conditioning", McGraw Hill Inc., 1990.

Reference Books:

1. Roy J Dossat: "Principles of Refrigeration"; Pearson Education Inc.
2. William H Crouse and Donald L Anglin: "Automotive air conditioning"
3. Arora and Damkondwar "Refrigeration and Air Conditioning";: Dhanpatrai and Company.
4. C. P. Arora: "Refrigeration and Air Conditioning", Tata McGraw Hills Pub.
5. Paul Weissler: "Automotive air conditioning" Reston Publishing Co. Inc.

AT-616:A2:- ALTERNATIVE FUELS AND ENERGY SYSTEMS

Total Credits : 2	Teaching Time / Week: (2 /Week)
Marks: 50 (10 CA + 40 UA)	

Course Description:

The "Alternative Fuels and Energy Systems" course delves into the exploration of alternative fuel sources for internal combustion engines. It offers insights into various alternative fuels, including alcohols, vegetable oils, hydrogen, biogas, natural gas, and LPG. Students will learn about the production methods, properties, and combustion characteristics of these fuels in both spark ignition (SI) and compression ignition (CI) engines. The course also addresses performance, emission, and combustion analyses, as well as safety aspects related to hydrogen storage. Students will gain a comprehensive understanding of the need, availability, and recent advancements in alternative energy systems.

Course Objectives:

1. Introduce students to various alternative fuels and energy sources for internal combustion engines.
2. Provide knowledge about the properties and production methods of alcohols as alternative fuels.
3. Explore the use of vegetable oils in engines, including their properties and performance.
4. Familiarize students with the properties, production methods, and challenges of hydrogen as an engine fuel.
5. Cover the production, properties, and usage of biogas, natural gas, and LPG in IC engines.

Course Outcomes:

1. Stay informed about recent advancements in alternative energy systems.
2. Analyze the combustion characteristics and safety considerations associated with alternative fuels.
3. Students will understand the need, availability of different alternative fuels and suitability of alcohol as an alternative fuel .
4. Students will understand the different methods of using vegetable oils as a fuel .
5. Students will understand the different methods of production and usage of hydrogen as an alternative fuel in engines.
6. Students will be able to compare the performance of different gaseous fuel as an alternative fuel for IC engines.
7. Students will understand the recent advancements available in the alternative energy systems.

Syllabus

Unit 1: Alcohols As Fuels (7 Hrs)

- Alternative fuels – Introduction, Need and Availability. Alcohols as fuel - Production methods, Properties.
- Methods of using alcohols in CI and SI engines. Blending, dual fuel operation,
- surface ignition and oxygenated additives.
- Performance, Emission and Combustion characteristics in CI and SI engines.

Unit 1: Vegetable Oils As Fuels (7 Hrs)

- Vegetable oils – Types and Properties. Different methods of using vegetable oils in engines – Blending,
- preheating Transesterification and emulsification Performance, Emission and Combustion Characteristics in diesel.

Unit 1: Hydrogen As Engine Fuel (8 Hrs)

- Hydrogen - Combustive properties, Production methods, Problems associated with hydrogen as fuel and solutions.
- Different methods of using hydrogen in SI and CI engines. Performance, Emission and Combustion analysis in engines. Hydrogen storage - safety aspects of hydrogen.

Unit 1: Biogas, Natural Gas And Lpg As Fuels (8 Hrs)

- Production methods of Biogas, Natural gas and LPG.Properties studies. CO2 and H2S scrubbing in Biogas.,
- Modification required to use in SI and CI Engines- Performance, Emission and Combustion characteristics of Biogas,
- NG and LPG in SI and CI engines.

Text Books:

1. Richard L Bechtold P.E., "Alternative Fuels Guide Book", Society of Automotive Engineers,ISBN 0-76-80-0052-1, 2014.
2. S.S. Thipse, "Alternative Fuels", Jaico Publishing House, 2012.

References:

1. Devaradjane. G., Kumaresan. M., "Automobile Engineering", AMK Publishers, 2013.
2. Gerhard Knothe, Jon Van Gerpen, Jargon Krahl, "The Biodiesel Handbook", AOCS Press Champaign, Illinois2005.
3. Ayhan Demirbas, "Biodiesel A Realistic Fuel Alternative for Diesel Engines", Springer-Verlag London Limited 2008, ISBN-13: 9781846289941.

AT-616:B2:- AUTOMOBILE MANUFACTURING PROCESS - II

Total Credits : 2	Teaching Time / Week: (2 /Week)
Marks: 50 (10 CA + 40 UA)	

Course Description :

"Automobile Manufacturing Process - II" is the continuation of the exploration of automotive manufacturing. Building on the foundation laid in the first part, this course delves deeper into advanced manufacturing techniques, automation, and optimization. Students study the latest trends and technologies in the industry, focusing on lean manufacturing, robotics, and process innovation. By the end of the course, students are equipped with a comprehensive understanding of the evolving landscape of automobile production and are ready to tackle complex manufacturing challenges.

Course Objectives:

1. To introduce students to fundamental concepts and techniques in various manufacturing processes .
2. To provide an in-depth understanding of forging, press operations, traditional and advanced welding processes.
3. To familiarize students with CNC machining and programming, which are essential skills in the automotive sector.
4. To develop problem-solving skills and the ability to make informed decisions related to manufacturing .
5. To instill safety consciousness and environmental considerations in manufacturing practices with standards.

Course Outcomes:

Upon successful completion of this course, students should be able to:

1. Understand the principles and applications of various manufacturing processes used in the automobile industry.
2. Differentiate between traditional and advanced welding processes and select appropriate techniques .
3. Apply knowledge of forging, press operations, and surface treatment methods to enhance the quality and durability.
4. Demonstrate proficiency in CNC programming and machining for precise and efficient manufacturing.
5. Evaluate and optimize manufacturing processes to meet industry standards and safety regulations.
6. Analyze case studies related to manufacturing processes in the automotive industry and propose practical solutions.
7. Stay updated with the latest advancements and trends in manufacturing technology within the automotive sector.

Syllabus

Unit 1: Advanced Welding Processes **(12 Hrs)**

- Advanced Welding Techniques: Laser and Electron Beam Welding
- Welding Joints and Positions for Advanced Welding, Weld Defects, Inspection, and Quality Control in Advanced Welding
- Specialized Welding Applications in Advanced Techniques,Advances in Welding Technology and Innovations
- Welding Codes and Standards for Advanced Welding, Case Studies in Advanced Welding
- Advanced Welding in the Automotive and Aerospace Industries

Unit 2: Surface Treatment Process **(10 Hrs)**

- Introduction to Surface Treatment, Surface Cleaning and Preparation, Coating and Plating Methods
- Anodizing and Electroplating, Thermal Spray and Powder Coating,
- Surface Modification Techniques, Corrosion Protection and Paint Systems
- Surface Treatment in Aerospace and Defense, Environmental Impacts and Regulations
- Quality Control in Surface Treatment

Unit 3: CNC Machine and Programming **(10 Hrs)**

- Introduction to CNC Machining, CNC Machine Components and Axes
- CNC Programming Fundamentals, G and M Codes in CNC Programming,CNC Tooling and Work holding

Reference Books:

1) "Manufacturing Processes for Engineering Materials" by Serope Kalpakjian and Steven R. Schmid.
2) "Welding: Principles and Applications" by Larry F. Jeffus.
3) "CNC Machining Handbook: Building, Programming, and Implementation" by Alan Overby.
4) "Surface Treatment and Finishing of Aluminium and Its Alloys" by Wernick, Pinner, and Sheasby.
5) "Introduction to Manufacturing Processes" by Mikell P. Groover.
6) "Fundamentals of Modern Manufacturing: Materials, Processes, and Systems" by Mikell P. Groover.

AT-625: Practical Based on AT 615

Total Credits : 1.5	Teaching Time / Week: (3 /Week)
Marks: 50 (10 CA + 40 UA)	

AT-615:A1:- TRANSPORT MANAGEMENT - II

1. Case Analysis of a Legal Issue Related to the Motor Vehicle Act:
2. Mock Driving License Application Process Simulation:
3. Traffic Sign Recognition Challenge:
4. Role-Playing Activity: Responsible Driver Interaction with Traffic Authorities:
5. Comparative Analysis of Different Vehicle Insurance Types (Life, Fire, Motor)
6. Mock Accident Claim Report and Settlement Procedure:
7. Research Project on the Role of Surveyors and Loss Assessors in Insurance:
8. Debate or Discussion on Road Safety Measures and Technologies:
9. Guest Lecture by a Transport Authority Representative
10. Field Visit to a Regional Transport Office (RTO)

AT-615:B1:- AUTOMOTIVE REFRIGERATION AND AIR CONDITIONING-II

1. Study of Sensor Operation (Temperature & Pressure)
2. Study of Actuator Mechanisms (Blend Door Motors, etc.)
3. Study of Fixed vs. Variable Displacement Control
4. Study of Semi-Automatic Temperature Control Systems
5. Study of Specialized Service Tools for Air Conditioning Systems
6. Study of System Diagnostics for Components and Air Delivery
7. Study of Automatic Temperature Control System Service Procedures
8. Study of Initial Vehicle Inspection Techniques for Air Conditioning
9. Study of Temperature and Pressure Measurement Techniques
10. Study of Leak Detection Methods (Electronic & Sight Glass)

AT-626: Practical Based on AT 616

Total Credits : 1.5	Teaching Time / Week: (3 /Week)
Marks: 50 (10 CA + 40 UA)	

AT-616:A2:- ALTERNATIVE FUELS AND ENERGY SYSTEMS

1. Study of Alternative fuels – Introduction, Need and Availability
2. Study of dual fuel operation
3. Study of Vegetable oils – Types and Properties
4. Study of surface ignition and oxygenated additives
5. Study of Methods of using alcohols in CI and SI engines
6. Study of hydrogen as engine fuel
7. Study of Hydrogen storage - safety aspects of hydrogen
8. Study of BIOGAS AS FUELS
9. Study of NATURAL GAS AS FUELS
10. Study of LPG AS FUELS

AT-616:B2:- AUTOMOBILE MANUFACTURING PROCESS - II

1. Study of Laser Beam Welding Principles through simulation and comparison with Electron Beam Welding.
2. Study of Weld Defect Inspection Techniques using industry standards and case studies.
3. Study of Surface Cleaning and Preparation Methods for different materials and coating applications.
4. Study of Corrosion Protection Mechanisms and their role in paint system design.
5. Study of G and M Codes in CNC programming through practical exercises.
6. Study of CNC Tooling and Work Holding techniques for secure and precise machining.
7. Study of a Case Study: Analyze a real-world scenario to select the right welding process for a specific automotive component.
8. Study of a Disassembled Automotive Component: Identify the manufacturing processes used, discuss potential improvements.

9. Study of Advanced Manufacturing Practices through a guest lecture from an automotive industry professional (if possible).
10. Study of Real-World Applications through a field visit to an automotive manufacturing plant

AT-517: SEC (G) Creative Abilities

Total Credits : 2	Teaching Time / Week : (2 /Week)
Marks: 50 CA	

Objectives

- Enhance workplace ethics and atmosphere through training and motivation.
- Master innovative idea conceptualization using five key dimensions.
- Develop proficiency in problem-solving for generating and growing business ideas.

Outcomes

- Enhancing ethics and work environment through training and motivation.
- Mastering five dimensions for successful innovation.
- Proficiency in problem-solving for business idea creation and growth.

Syllabus

Unit I Boosting Morale (7 Hrs)

Boosting ethics & Development work environment, ethics theory, Development of work environment & training process, knowledge of presentation & self motivation.

Unit II Innovative Dimensions: (12 Hrs)

Five Dimensions to conceptualize your idea to make it a successful innovation. When conceptualizing an idea, it is essential to ask questions like what is the problem that the idea solves, who is the consumer for the idea, does the idea solve the consumer's problems and how will the solution be delivered to the consumer. It is very important to direct the thinking to specific dimensions and search answers to certain questions that help in evolving the idea from the initial thought through the various stages of innovation.

Unit III Business Idea Generation and Growth (9 Hrs)

The single most effective way to come up with a business idea is to solve a problem. Next step, you bring the idea to life. Whether it's code, carpentry, or culinary, a project is a created idea. When the project is nearly complete and it's time to begin putting the project into the hands of real people. Once your project is perfected through testing, it's time to come up with a way to make money from it. Growth - Get the word out about the thing.

Text Books & References books

1. "Boosting Employee Morale" by Bob Nelson - for Unit I: Boosting Morale.
2. "The Innovator's Dilemma: When New Technologies Cause Great Firms to Fail" by Clayton M. Christensen - for Unit II: Innovative Dimensions.
3. "The Lean Startup: How Today's Entrepreneurs Use Continuous Innovation to Create Radically Successful Businesses" by Eric Ries - for Unit III: Business Idea Generation and Growth.

AT-517: SEC (G) Digital Skills

Total Credits : 2	Teaching Time / Week : (2 /Week)
Marks: 50 CA	

Objectives

- Develop effective written communication skills for professional correspondence such as memos and emails.
- Gain proficiency in operating various digital tools and technologies essential for modern workplace environments.
- Understand the importance of information security policies and their implications for safeguarding digital data within organizational boundaries.
- Apply knowledge of communication strategies to effectively communicate with stakeholders including customers, co-workers, and vendors.
- Acquire skills in implementing and adhering to information security policies to ensure compliance and mitigate digital security risks.

Outcomes

- Enhance written communication skills for professional correspondence through memos and emails.
- Master the operation of diverse digital tools and technologies crucial for contemporary workplaces.
- Comprehend the significance of Information Security Policy (ISP) in safeguarding digital data within organizational boundaries.
- Apply communication strategies effectively to communicate work updates and request information from stakeholders.
- Implement information security policies to ensure compliance and mitigate digital security risks within the organization.

Syllabus

Unit I : Communication Strategies (8 Hrs)

Write memos and e-mail to customers, co-workers, and vendors to provide them with work updates and to request appropriate information.

Unit II Digital Tools (12 Hrs)

Operate all types of digital tools like laptops, palmtops, mobiles, fax machines, printers, projectors, conferencing tools effectively. Attributes that feature in the emergence of novel technologies are: (i) radical novelty, (ii) relatively fast growth, (iii) coherence, (iv) prominent impact, and (v) uncertainty and ambiguity. The framework for operationalising emerging technologies is then elaborated on the basis of the proposed attributes.

Unit III : Information Security Policy (10 Hrs)

Understanding and adhering to the Information security aspects of the organization based on ISP. Information Security Policy (ISP) is a set of rules enacted by an organization to ensure that all users or networks of the IT structure within the organization's domain abide by the prescriptions regarding the security of data stored digitally within the boundaries the organization stretches its authority.

Text Books & References Books

1. "Business Communication: Building Critical Skills" by Kitty Locker and Stephen Kyo Kaczmarek – for Communication Strategies.
2. "Digital Literacy For Dummies" by Faithe Wempen - for Digital Tools.
3. "Information Security Management Handbook" by Harold F. Tipton and Micki Krause Nozaki - for Information Security Policy.