Shri Vaishnav Vidyapeeth Vishwavidyalaya, Indore
Shri Vaishnav Institute of Technology and Science
Choice Based Credit System (CBCS) in Light of NEP-2020
B.Tech. in Automobile Engineering
(2023-2027)

COURSE CODE	CATE-GORY	COURSE NAME	TEACHING &EVALUATION SCHEME								
			THEORY			PRACTICAL		L	T	P	CREDITS
			END SEM University Exam	Two Term Exam	Teachers Assessment*	END SEM University Exam	Teachers Assessment*				
BTAU501A	DE	EV BATTERIES AND CHARGING SYSTEM	60	20	20	30	20	3	0	2	4

Legends: **L** - Lecture; **T** - Tutorial/Teacher Guided Student Activity; **P** – Practical; **C** - Credit;
***Teacher Assessment** shall be based following components: Quiz/Assignment/ Project/Participation in Class, given that no component shall exceed more than 10 marks.

Course Educational Objectives (CEOs):
To introduce the learners about batteries, their parameters, modeling and charging infrastructure, power transfer, and converters.

Course Outcomes (COs):
Students will:
1. Students would be able to elaborate on various technical parameters of batteries.
2. Students would be able to distinguish between various types of batteries used for EV applications.
3. Students would be able to develop battery chargers for an EV.
4. Students would be able to understand power transfer technology and charging station's work.

Syllabus

UNIT I

Introduction: Cells & Batteries, Nominal voltage and capacity, C rate, Energy and power, Energy efficiency, Self-discharge rates, Battery geometry, Battery temperature, heating and cooling needs, Battery life, Battery indicator, Cells connected in parallel, Rechargeable cell, Charging and Discharging Process, Overcharge and Undercharge, Modes of Charging.

UNIT II

Batteries: Introduction, Types; Lead Acid Batteries, Nickel-based Batteries, Sodium-based Batteries, Lithium Batteries, Metal Air Batteries, Special characteristics of batteries, Battery life and maintenance, Battery charging.

UNIT III

EV Charging: Battery Chargers, Charge equalization, Charger circuits basic and Microprocessor based, Arrangement of an off-board conductive charger, Standard power levels of conductive chargers, Inductive charging.

Charging Infrastructure: Introduction, understanding charging economics, Commercial charging and pricing models, Load managements for large scale EV integration, Domestic Charging Infrastructure, Public Charging Infrastructure.

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UNIT IV

Power Transfer & Converters: Overview of series, parallel and series-parallel resonance converter, LLC resonant converter, Dual Active Bridge (DAB) Converter; topology, operation and control.

Wireless Power Transfer (WPT) for Electric Vehicles (EVs): Basics of WPT Technology, Modelling the WPT System, WPT for EV Charging, Design Challenges and Optimization Candidates, Future Directions and Trends.

Battery Charger Impact on Grid: 1-phase fully controlled converter, 3-phase fully controlled converter, strategy used for power factor correction, Harmonics Impact, Current Demand Impact and current demand minimization.

UNIT V

Electric Vehicles Charging station: Types, Selection and Sizing of charging station, Components of charging station, Single line diagram of charging station, Electric vehicle integration issues-Battery Performance and cost.

Text Books:

1. *"Advances in Battery Technologies for Electric Vehicles" by Bruno Scrosati, Jürgen Garche, Werner Tillmetz, Woodhead Publishing, 2015.*
2. *"Advanced Battery Management Technologies for Electric Vehicles" (Automotive Series) 1st Edition by by Rui Xiong (Author), Weixiang Shen, willy, 2020.*
3. *"Electric Vehicle Technology" Explained by James Larminie Oxford Brookes University, Oxford, UK John Lowry Acenti Designs Ltd., UK.*
4. *"Modern Electric Vehicle Technology" by C.C Chan, K.T Chau, Oxford University Press Inc., New York 2001.*
5. *"Modern Electric, Hybrid Electric and Fuel Cell Vehicles: Fundamentals, Theory and Design" by Mehrdad Ehsani, Yimi Gao, Sebastian E. Gay, Ali Emadi, CRC Press, 2004.*

Reference Books:

1. *"Electric and Hybrid Vehicles Power Sources, Models, Sustainability, Infrastructure and the Market"*

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by Gianfranco Pistoia Consultant, Rome, Italy, Elsevier Publications, 2017.

2. *"Energy Management Strategies for Electric and Plug-in Hybrid Electric Vehicles" by Sheldon S. Williamson; Springer, 2013.*
3. *"Modern Electric Vehicle Technology" by C.C. Chan and K.T. Chau; Publisher: OXFORD University Press, 2001*
4. *"Hybrid Electric Vehicles Principles and Applications with Practical Perspectives" by Chris Mi, M. Abul Masrur, David Wenzhong GAO; Publisher: Wiley Publication, 2011.*
5. *"Electric Vehicle Technology Explained" by James Larminie, John Lowry Wiley, 2003.*
6. *"Battery management systems, Volume I: Battery modeling by Plett, Gregory L. Artech House, 2015.*
7. *"Battery management systems, Volume II: Equivalent-circuit methods by Plett, Gregory L. Artech House, 2015.*
8. *"Battery Management Systems - Design by Modelling" by Bergveld, H.J., Kruijt, W.S., Notten, P.H.L Philips Research Book Series 2002.*
9. *Electric and Hybrid Vehicles: Design Fundamentals by Iqbal Hussein, CRC Press, 2003.*

List of Experiments

1. To study the various technical parameters and terminologies of batteries.
2. To observe the charging and discharging process, and plot graph of charging/load current, SOC, temperature, DOC, and terminal voltage.
3. To distinguish between various types of batteries used for EV's.
4. To analyze the effect of temperature on the performance of a Lead Acid battery model.
5. To analyze the effect of temperature on the performance of a Nickel-based battery model.
6. To analyze the effect of temperature on the performance of a Lithium-Ion battery model.
7. To study Lithium Battery Cell - One RC-Branch Equivalent Circuit and it's simulation.
8. To Simulation of Battery Charging by using AC – DC converter
9. To study the power transfer technology and charging station's work.
10. To study about electric vehicle charging system.

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BTAU501B	DE	**VEHICLE DIAGNOSTICS**	60	20	20	30	20	3	0	2	**4**

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Course Educational Objectives (CEOs):

The objective of the course is to describe the (A) Machine Faults, (B) Measurement of fault (C) Data acquisition and signal processing techniques, (D) Fault Diagnosis.

Course Outcomes (COs):

After completion of this course the students are expected to be able to demonstrate the following:

1. Students would be familiar with vehicle fault diagnostic procedures.
2. Students would be able to identify, repair, solve, and prepare reports of various engine components and chassis systems-related problems.
3. Students would be able to identify, repair, solve, and prepare report of electrical system-related faults.
4. Students would be able to diagnose the faults of the lubrication system and cooling system etc.

Syllabus

Unit I

Maintenance Schedules and Records: Importance of maintenance, preventive (scheduled) and breakdown (unscheduled) maintenance, requirements of maintenance, preparation of check lists. Inspection schedule, Maintenance of records and its formats; log sheets and other forms, safety precautions in maintenance.

Unit II

Engine Diagnostics: Dismantling of engine components and cleaning, cleaning methods, visual and dimensional inspections, minor and major reconditioning of various components, reconditioning methods, engine assembly, special tools used for maintenance overhauling, engine tune up.

Transmission, Suspension and Steering Diagnostics: Diagnostics of automobile clutch and gear box, servicing/maintenance of propeller shaft and differential system. Diagnostics of suspension systems problems, Steering systems; overhauling and maintenance. Wheel alignment; computerized alignment and wheel balancing.

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Unit III

Electrical System Diagnostics: Testing methods for checking electrical components, checking battery, starter motor, charging systems, DC generator and alternator, ignitions system, lighting systems. Fault diagnosis and maintenance of modern electronic controls, checking and servicing of dash board instruments.

Unit IV

Cooling System Diagnostics: Servicing and maintenance of fuel system of different types of vehicles, calibration and tuning of engine for optimum fuel supply. Cooling systems problems: braking systems, Traction control system, Stability Control system, air conditioning, water pump, radiator, thermostat, anti-corrosion and antifreeze additives. Lubrication maintenance, lubricating oil changing, greasing of parts. Vehicle body maintenance, Minor and major repairs. Door locks and window glass actuating system maintenance.

Unit V

Brake and Safety System Diagnostics: Active and passive safety, airbags, tightening system, forward collision warning systems, Brake systems problems and their rectification. child lock, anti-lock braking systems, EBD, traction control system and lane departure warning system, Adaptive cruise control system, Global positioning system, geographical information systems, navigation system, remote keyless entry, smart card system and number plate coding.

Text and References Books:

1. *"Advanced Engine Performance Diagnosis" by James D. Halderman, PHI, 2011.*
2. *"Bosch Automotive Handbook", Sixth Edition, 2004.*
3. *"Maintenance planning and control" by Higgin L.R. Mc Graw Hill, 1997.*
4. *"Practical Machinery Vibration Analysis and Predictive Maintenance" by C. Scheffer & Paresh Girdhar; Elsevier, 2004.*

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***Teacher Assessment** shall be based following components: Quiz/Assignment/ Project/Participation in Class, given that no component shall exceed more than 10 marks.

5. *"Vehicle Maintenance and Garage Practice" by Jigar A. Doshi, D.U. Panchal and J. P. Maniar, PHI Learning Pvt. Ltd, 2014.*
6. *"Advanced automotive fault diagnosis" by Tom Denton, Elsevier BH, 2006.*
7. *"Automotive Computer Controlled Systems" By Allan W. M. Bonnick, Butterworth-Heinemann A division of Reed Educational and Professional Publishing Ltd*
8. *"Intelligent Vehicle Technologies", by Ljubo Vlacic, Michel Parent and Fumio Harashima, Butterworth - Heinemann publications, Oxford, 2001.*
9. *"Sensors and Transducers" By Ronald K.Jurgen - SAE 2003*

List of experiments

1. Identify, repair, solve, and prepare reports on maintenance of automobile components & general vehicle architecture.
2. Identify, repair, test, and prepare reports of cylinder re-boring, valve grinding, and valve lapping.
3. To study and prepare report on the constructional details, working principles and operation of the automotive transmission systems.
4. To study and prepare report on the constructional details, working principles and operation of the automotive suspension systems.
5. To study and prepare a report on the testing of kingpin inclination, toe-in, and toe-out.
6. To study and prepare a report on the wheel balancing and 'wheel alignment – testing of camber, caster'.
7. Trace, test, and prepare reports of all electrical, and electronic components & circuits and to ensure the functionality of the system.
8. Identify battery pack components and check the performance of energy storage systems.
9. To study and prepare report on the constructional details, working principles and operation of the engine cooling systems.
10. To study and prepare report on the constructional details, working principles and operation of the Automotive Brake Systems.
11. Diagnose, repair, and testing of automotive vehicles safety system and components.

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Choice Based Credit System (CBCS) Scheme in light of NEP-2020

B. Tech in Mechanical/Automobile Engineering

(2023 -2027)

COURSE CODE	CATEGORY	COURSE NAME	TEACHING &EVALUATION SCHEME								
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			END SEM University Exam	Two Term Exam	Teachers Assessment*	END SEM University Exam	Teachers Assessment*				
BTCSME501	DSE	ARTIFICAIL INTELLIGENCE AND MACHINE LEARNING	60	20	20	30	20	3	0	2	4

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Course Educational Objectives (CEOs)

This course provides a fundamental knowledge of (A) Artificial Intelligence (AI) (B) Machine Learning (ML) and (C) Mathematics and algorithms related to AI & ML.

Course Outcomes (COs)

After Completing the course student should be able to:

1. Understand the artificial intelligence and use.
2. Understand knowledge representation and logic programming and apply it.
3. Understand machine learning and mathematical foundation and principles.
4. Understand Learn various mathematical techniques used in AI & ML.
5. Apply knowledge of computing and mathematics to machine learning problems, models and algorithms.

Syllabus

Unit – I **(8 Hrs)**

Introduction to AI: Definition of AI, types of AI techniques, problem solving using state space search, applying heuristics, hill climbing, search using BFS, DFS.

Unit – II **(8 Hrs)**

Knowledge Representation and Logic Programming : Representing knowledge as a rules, representing simple facts in logic, computable functions and predicates, procedural vs declarative knowledge, forward vs backward reasoning, logical programming-predicates logic.

Unit – III **(10 Hrs)**

Introduction to Machine Learning and basic concepts: Definition, scope and limitations of ML, basic concepts of regression, probability, statistics and linear algebra for machine learning, basic concepts of convex optimization, data visualization, hypothesis function and testing, data distributions, data preprocessing, data augmentation, normalizing data sets, machine learning models, supervised and unsupervised learning.

Unit – IV **(10 Hrs)**

Linear Regression: Model representation for single variable, single variable cost function, gradient decent for linear regression, gradient decent in practice.

Logistic Regression: Hypothesis representation, decision boundary, cost function, optimization,

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multi classification (one vs all), problem of over-fitting.

Unit-V **(9 Hrs)**

Supervised and Unsupervised Learning: Discussion on clustering and classification algorithms, Naïve Bayes theorem, decision tree, SVM.

Introduction to Neural Network: Introduction, types of neural network, application in machine learning.

Text Books:

1. *Christopher M. Bishop, "Pattern Recognition and Machine Learning", Springer-Verlag New York Inc., 2nd Edition, 2011.*
2. *Tom M. Mitchell, "Machine Learning", McGraw Hill Education, First edition, 2017.*
3. *Ian Good fellow and Yoshua Bengio and Aaron Courville, "Deep Learning", MIT Press, 2016.*
4. *Christopher M. Bishop, "Pattern Recognition and Machine Learning" Springer, 2010*

Reference Books:

1. *E. Rich, K. Knight and S. B. Nair, "Artificial Intelligence" McGraw Hill Education, 3rd edition, 2017.*
2. *Francois Chollet, "Deep Learning with Python", Manning Publications, 1st edition, 2018.*
3. *Andreas Muller, "Introduction to Machine Learning with Python: A Guide for Data Scientists", Shroff/O'Reilly, 1st edition, 2016.*
4. *S. Russell and N. Norvig, "Artificial Intelligence: A Modern Approach", Prentice Hall Series in Artificial Intelligence, 2003.*

List of Experiments

1. Implementation of logic rules in python
2. Apply the concept of linear regression using appropriate data.
3. Apply the concept of gradient regression using appropriate data.
4. Apply the concept of logistic regression using appropriate data.
5. To add missing value in data set.
6. Perform and plot under fitting and over fitting in a data set.
7. Implementation of clustering algorithms.
8. Implementation of classification algorithms.

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BTAU502A	DE	ALTERNATIVE FUELS AND EMISSION CONTROL	60	20	20	0	0	3	0	0	3

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Course Educational Objectives (CEOs):

Student will be able to (A) understand about alternative fuels, their potential as replacements for conventional fossil fuels, (B) Associated pollution control technologies and (C) learn about emission reduction strategies for sustainable mobility.

Course Outcomes (COs):

After completion of this course the students will be able:

1. To understand the significance of alternative fuels in reducing environmental impact and achieving sustainable transportation.
2. To examine the different generations of biodiesel production techniques and understand their advantages and challenges.
3. To evaluate biodiesel quality standards and compatibility with existing diesel engines.
4. To explore the latest research and innovations in alternative fuel technologies.

Syllabus

Unit I

Introduction: Introduction to Alternative Fuel, need of alternative fuels in the automotive sector, Types of alternative fuels: biofuels; biodiesel, bio ethanol's and bio gas. hydrogen, natural gas, LPG etc., Production processes and sources of alternative fuels. Advantages and challenges of using alternative fuels in vehicles, bio ethanol's production, advantages and challenges, Challenges of alternative fuel production in Asian countries. Energy scenario of India, Crude oil and petroleum products availability in India.

Unit II

Hydrogen as an Automotive Fuel: Production methods; steam methane reforming, electrolysis, etc. Hydrogen storage and infrastructure challenges, Fuel cell vehicles and hydrogen combustion engines.

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Natural Gas and LPG as Fuels: Production methods, Compressed Natural Gas (CNG) and Liquefied Petroleum Gas (LPG), advantages and challenges, Impact on engine performance and emission, Infrastructure and storage considerations.

Unit III

Biodiesel generations and production: Introduction, what is Biodiesel, applications of biodiesel, Generation of biodiesel; benefits and comparison, Advantages and disadvantages of third-generation biodiesel, Biodiesel production process for different generations; Transesterification, Acid-Catalyzed Esterification, Enzymatic Transesterification, Supercritical Methanol Transesterification, Microwave-Assisted Transesterification, Ultrasonic Transesterification, Factors affecting transesterification reaction, Biodiesel Production steps, Advantages of biodiesel, The advantages and disadvantages of Petro diesel and biodiesel, Future prospects,

Unit IV

Biodiesel Quality, Standards and Properties: Deference between diesel and bio diesel, Biodiesel Properties, Biodiesel Properties comparison with diesel, Biodiesel standardization world-wide. Bio diesel blends properties impact on performance, combustion & Emission parameter of IC Engine.

Unit V

Emission Control: Greenhouse gas emissions (CO, CO_2, CH_4, N_2O) from various fuels, Air pollutants (NOx, CO, HC, PM) and their effects on air quality and health. Emission Control Technologies; Catalytic converters, Selective Catalytic Reduction (SCR) for NOx reduction, Particulate filters etc.

Policy and Regulatory Framework: Government incentives and policies promoting alternative fuels, Emission standards and regulations for cleaner vehicles, international efforts toward sustainable

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mobility, Overview of national biofuel policies, Technological barriers and limitations of alternative fuels, Future trends and innovations in pollution control and sustainable transportation.

Text Books:

1. *"Internal Combustion Engines" by Ganeshan –Tata McGraw Hill, 2008.*
2. *"Internal Combustion Engines" by Heywood John-- McGraw Hill, 2018.*
3. *"Automotive Emission Control" by Crouse and Anglin –McGraw Hill, 1977.*
4. *"Non-conventional Energy Sources"by G.D. Rai, Khanna Pub, 1992.*
5. *"Alternative Fuels" by S.S. Thipse, Jaico Publishing House, 2010.*
6. *"Internal Combustion Engines" by Ferguseaon, John Wiley & Sons, 2001.*

Reference Books:

1. *"Handbook of Alternative Fuel Technologies" by James G. Speight and Sudarshan K. Loyalka, CRC Press, 2007.*
2. *"Biodiesel, combustion, performance and emissions characteristics" by Maroa S and Inambao F. Green Energy and Technology, Springer Nature, 2020.*
3. *"Alternative Fuels and Their Utilization Strategies in Internal Combustion Engines" by Akhilendra Pratap Singh, Yogesh C. Sharma, Nirendra N. Mustafi, Energy, Environment, and Sustainability, Springer, 2020.*
4. *"Biodiesel Production with Green Technologies" by Aminul Islam and Pogaku Ravindra, Springer International Publishing Switzerland 2017.*
5. *"Practical Handbook on Biodiesel Production and Properties" by Mushtaq Ahmad, Mir Ajab Khan, Muhammad Zafar and Shazia Sultana, Taylor & Francis Group, LLC 2013.*
6. *"Biodiesel – Quality, Emissions and By-Products" by Gisela Montero and Margarita Stoytcheva, Intech, 2011.*

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COURSE CODE	CAT-EGO-RY	COURSE NAME	TEACHING &EVALUATION SCHEME								
			THEORY			PRACTICAL		L	T	P	CREDITS
			END SEM University Exam	Two Term Exam	Teachers Assessment*	END SEM University Exam	Teachers Assessment*				
BTAU502B	DE	ENGINE TESTING AND CERTIFICATION	60	20	20	0	0	3	0	0	3

Legends: **L** - Lecture; **T** - Tutorial/Teacher Guided Student Activity; **P** – Practical; **C** - Credit;
***Teacher Assessment** shall be based following components: Quiz/Assignment/ Project/Participation in Class, given that no component shall exceed more than 10 marks.

Course Educational Objectives (CEOs):

Students will be equipped with the knowledge and practical expertise to (A) conduct engine tests, evaluate engine performance and emissions, and (B) understand the significance of certification in meeting environmental regulations and (C) developing efficient and environmentally friendly internal combustion engines.

Course Outcomes (COs):

Upon the successful completion of the course, students will be able:

1. To Understand the fundamentals of HCCI engines, including the principles of autoignition and combustion characteristics.
2. To Gain knowledge of engine testing methodologies and evaluate engine performance parameters, and emissions under controlled conditions.
3. To Familiarize with various engine testing equipment and sensors used for data acquisition.
4. To develop practical skills in engine performance testing, including conducting tests at various operating conditions and identify areas for optimization.
5. Explore engine emissions testing techniques to measure exhaust emissions and understand the standards for emissions certification.

Syllabus

UNIT I

HCCI Engine Fundamental: Introduction, Definition and concept of Homogeneous Charge Compression Ignition (HCCI), Comparison with conventional spark-ignition (SI) and compression-ignition (CI) engines, Advantages and challenges of HCCI combustion, HCCI Combustion Process, Temperature and pressure effects on auto-ignition & Compression ignition, Combustion timing and control, Operating Principles and Control Strategies. Combustion Chamber Design, Design considerations for HCCI engines, Piston and cylinder head design, Impact of chamber design on combustion efficiency.

UNIT II

Engine Testing: Introduction, Definition and scope of engine testing, Importance of engine testing in research, development, and quality assurance, Types of Engine Tests, Performance testing; Power output, torque, fuel consumption and efficiency measurement. Emission testing; Measurement

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COURSE CODE	CAT-EGO-RY	COURSE NAME	TEACHING &EVALUATION SCHEME								
			THEORY			PRACTICAL		L	T	P	CREDITS
			END SEM University Exam	Two Term Exam	Teachers Assessment*	END SEM University Exam	Teachers Assessment*				
BTAU502B	DE	ENGINE TESTING AND CERTIFICATION	60	20	20	0	0	3	0	0	3

Legends: **L** - Lecture; **T** - Tutorial/Teacher Guided Student Activity; **P** – Practical; **C** - Credit;
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and analysis of exhaust gases, Durability testing; Endurance and reliability assessment. Combustion analysis; Cylinder pressure, Cylinder temperature, ignition delay and heat release analysis.

UNIT III

Engine Testing Equipment's & Sensors: Engine's torque measurements: Dynamometers, Types; eddy current dynamometers, hydraulic dynamometers, and electric dynamometers, cylinder pressure measurements; Pressure Transducers, Exhaust gas temperatures, Coolant temperatures, and other critical engine temperatures measurement sensors and Thermocouples, Air-Fuel Ratio (AFR) Sensors, Lambda Sensors, Smoke Meters, Fuel Flow Meters, Opacity Meters, Ignition Analyzers, Exhaust Gas Analyzers, Data Acquisition Systems, Engine Management Systems (EMS), Combustion Analysis Systems, Humidity Measurement, Calibration Measurement.

UNIT IV

Engine Performance Testing: Measurement of Power Output; Calculation of brake power (BP) and indicated power (IP). Torque Measurement: Measuring engine torque using dynamometers or strain gauges, Relationship between torque and power. Fuel Consumption Measurement; Determining fuel flow rate and fuel consumption, Calculation of Brake Specific Fuel Consumption (BSFC), Measuring Air-Fuel Ratio (AFR), Calculation and significance of BMEP, Performance Testing at Different Speeds, Loads, Nozzle pressure, Compression ratio and Valve Timings.

UNIT V

Engine Emissions Testing: Definition and types of engine emissions (NOx, CO, HC, PM, etc.), Sources and factors influencing engine emissions, Environmental and Health Impacts, Emission Measurement Techniques; Gas analyzers for measuring exhaust gas concentrations, Particulate matter (PM) measurement techniques, Emission sampling and sample conditioning. Emission Control Technologies; Catalytic converters, Selective Catalytic Reduction (SCR) for NOx reduction, Particulate filters, Emission Regulations and Standards, Impact of Fuel Properties on Emissions, Advancements in emission control technologies.

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			THEORY			PRACTICAL		L	T	P	CREDITS
			END SEM University Exam	Two Term Exam	Teachers Asssessment*	END SEM University Exam	Teachers Assessment*				
BTAU502B	DE	ENGINE TESTING AND CERTIFICATION	60	20	20	0	0	3	0	0	3

Legends: **L** - Lecture; **T** - Tutorial/Teacher Guided Student Activity; **P** – Practical; **C** - Credit;
***Teacher Assessment** shall be based following components: Quiz/Assignment/ Project/Participation in Class, given that no component shall exceed more than 10 marks.

Text Books:

1. *A.J.Martyr, M. A.Plint, "Engine Testing Theory and Practice", 3rd edition, SAE International, 2007.*
2. *Michael James Plint & Tony Martyr, "Engine Testing- Theory & Practice", 3rd edition, SAE International, 2007.*
3. *Willard W. Pulkrabek. Engineering Fundamentals of the Internal Combustion Engine Second Edition. Pearson New International Edition, British Library cataloguing-in-publication data 2014; Harlow, United Kingdom.*
4. *Maroa S and Inambao F. Biodiesel, combustion, performance and emissions characteristics, Green Energy and Technology, Springer Nature, 2020.*
5. *"Engine Testing: Theory and Practice" by A. J. Martyr and M. A. Plint, Butterworth-Heinemann; 3rd edition, 2011.*
6. *B.P. Pundir, Engine Combustion and Emission, 2011, Narosa Publishing House.*
7. *Thipse.S.S., Alternative Fuels; Concepts, Technologies and Developments, Jaico Book Distributors, 2010*

Reference Books:

1. *Heniz Heisler, "Advanced Engine Technology", Vol. 1, SAE International 2002.*
2. *Richard D Atkins, "An Introduction to Engine Testing & Development", ISBN 978-0-7680-2099-1, SAE International 2009.*
3. *John B Heywood, "Internal Combustion Engines Fundamentals", McGraw Hill International Edition, 1988.*
4. *Hua Zhao "HCCI and CAI Engines for automotive industry" Wood Head Publishing in Mechanical Engineering, 2007.*

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COURSE CODE	CAT-EGO-RY	COURSE NAME	TEACHING &EVALUATION SCHEME								
			THEORY			PRACTICAL		L	T	P	CREDITS
			END SEM University Exam	Two Term Exam	Teachers Assessment*	END SEM University Exam	Teachers Assessment*				
BTAU502C	DE	LOGISTICS MANAGEMENT AND WAREHOUSING	60	20	20	0	0	3	0	0	3

Legends: **L** - Lecture; **T** - Tutorial/Teacher Guided Student Activity; **P** – Practical; **C** - Credit;
***Teacher Assessment** shall be based following components: Quiz/Assignment/ Project/Participation in Class, given that no component shall exceed more than 10 marks.

Course Educational Objectives (CEOs):

Students will possess the knowledge and skills required to (A) efficiently plan, coordinate, and optimize logistics operations, (B) including warehousing and distribution, contributing to (C) enhanced supply chain performance, reduced costs, and improved customer satisfaction.

Course Outcomes (COs):

Students will be able to

1. Understand the fundamentals of logistic management and its significance in supply chain operations.
2. Analyze and comprehend commercial geography and its role in optimizing transportation routes and strategies.
3. Explore multimodal transport and its advantages in creating efficient and cost-effective transport solutions.
4. Familiarize with international transport conventions and documentation to facilitate seam-less global trade.
5. Gain insights into clearance processes and their importance in international logistics operations.

Syllabus

UNIT I

Basics of logistics management: Introduction to physical distribution, Logistics management and its elements, Modern concepts in logistics, Role of logistics in strategy, Inbound and outbound supply chain management, Container – types, Different types of cargo, Packaging and material handling.

UNIT II

Commercial geography: Definition, Nature and scope of commercial geography, Role of industries in economic development, Factors of Industrial Location, Weber's theory of industrial location, Major industrial regions of India, Need and importance of transportation in commercial development, Geographical factors affecting international Trade, Major logistics routes in India, Major trade routes in world, International logistics and economic development, Role of intermediaries in international trade.

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			THEORY			PRACTICAL		L	T	P	CREDITS
			END SEM University Exam	Two Term Exam	Teachers Assessment*	END SEM University Exam	Teachers Assessment*				
BTAU502C	DE	LOGISTICS MANAGEMENT AND WAREHOUSING	60	20	20	0	0	3	0	0	3

Legends: **L** - Lecture; **T** - Tutorial/Teacher Guided Student Activity; **P** – Practical; **C** - Credit;
***Teacher Assessment** shall be based following components: Quiz/Assignment/ Project/Participation in Class, given that no component shall exceed more than 10 marks.

Multimodal transport: Introduction, Carriage by air, sea, road and rail, Types of vessels, Operators (Vessel and other), Freight forwarders and NVOCC, Outsourcing of logistics services, Overview of MMTG Act (1993).

UNIT III

International transport conventions: Legal agreements between countries and the UN, Multilateral transport agreements, Convention on road traffic, TIR procedures, CMR convention, Importance of international conventions.

Documentation and clearance processes: Foreign Trade Policy, Export and Import procedures, Documents Related to Export and Import, Instruments and terms of payment in Export – Import, Methods of export - import financing, Letter of credit and bill of exchange, foreign exchange regulations and formalities, Cargo insurance, International commercial terms, Procedure and documentation for availing export incentives, Bill of lading other documents, GST way bill and other documents.

UNIT IV

Trends in logistics: Introduction – recent developments in logistics, Transport and mobility technologies, green logistics, Cold chain logistics, Block chain and big data analytics in logistics, Transport services, Costing and performance, Administration and control and use of IT.

Warehousing: Introduction to warehousing, Warehouse functions, Warehouse types, Warehouse providing value added services, Warehouse internal operations, Warehousing equipment, Inventory, Safety and security in warehouses, Future trends in warehousing.

UNIT V

International Commercial Terms: Definition, purpose, and significance of Incoterms in global trade, Incoterms role in international commerce. Classifies Incoterms into two categories: Transport (EXW, FCA, CPT, CIP, DAP, DPU, DDP), Sea & Inland waterways (FAS, FOB, CFR, CIF). Role of Incoterms in logistics and supply chain management, buyer-seller responsibilities and risk management. Application in warehousing and cost and risk allocation. Legal and financial implications;

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BTAU502C	DE	LOGISTICS MANAGEMENT AND WAREHOUSING	60	20	20	0	0	3	0	0	3

Legends: **L** - Lecture; **T** - Tutorial/Teacher Guided Student Activity; **P** – Practical; **C** - Credit;
***Teacher Assessment** shall be based following components: Quiz/Assignment/ Project/Participation in Class, given that no component shall exceed more than 10 marks.

Contract negotiations, Pricing strategies, Customs clearance, and insurance considerations. Packaging and material handling under different Incoterms. Selection of appropriate Incoterms based on cost, risk, and operational needs.

Text Books:

1. *"Fundamentals of Logistics Management" (The Irwin/McGraw-Hill Series in Marketing), Douglas Lambert, James R Stock, Lisa M. Ellram, McGraw-Hill/Irwin, First Edition, 1998.*
2. *"Logistic Management" (2nd Edition.) by Vinod V. Sople (2009), Pearson Limited.*
3. *"Logistical Management" by Donald J. Bowersox & David J. Closs, Tata McGraw Hill Publishing Co. Ltd, New Delhi, 2004.*
4. *"Logistics Management" by Satish C. Ailawadi & Rakesh Singh: Prentice-Hall of India Pvt Ltd., New Delhi, 2005.*
5. *"Management For International Business: Text and Cases" by Sudalaimuthu & S. Anthony Raj, PHI Learning, First Edition, 2009.*

Reference books:

1. *"Introduction to Shipping, Institute of Chartered Shipbrokers" by Witherby Seamanship International Ltd, 2nd Revised edition, 2009.*
2. *International Logistics, Second Edition by Donald F. Wood, Anthony P. Barone, Paul R. Murphy, Daniel L. Wardlow, American Management Association, 2002.*
3. *"Global Supply Chain Management and International Logistics" by Alan E. Branch, Routledge: Taylor & Francis group 2009.*

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			THEORY			PRACTICAL		L	T	P	CREDITS
			END SEM University Exam	Two Term Exam	Teachers Assessment*	END SEM University Exam	Teachers Assessment*				
BTAU403	DCC	AUTOMOTIVE ENGINES	60	20	20	30	20	3	0	2	4

Legends: **L** - Lecture; **T** - Tutorial/Teacher Guided Student Activity; **P** – Practical; **C** - Credit;
***Teacher Assessment** shall be based following components: Quiz/Assignment/ Project/Participation in Class, given that no component shall exceed more than 10 marks.

Course Educational Objectives (CEOs)

This course provides a fundamental understanding (A) To impart the knowledge of working of I.C. engines (B) To impart the knowledge of fuel injection and ignition system (C) To impart the detail knowledge of fuel combustion (D) To develop the knowledge of cooling and lubrication system of IC engines (E) To impart the ability of determination of engine performances through Testing.

Course Outcomes (COs)

After completion of this course the students are expected to be able to demonstrate following knowledge, skills and attitudes

1. Explain the working of IC engines and air standard cycles.
2. Describe the fuel injection and ignition system.
3. Illustrate the engine combustion parameters.
4. Understand the cooling and lubrication system.
5. Evaluate Engine performance, combustion and emission Parameters.

Syllabus

Unit – I

Air Standard Cycles: Internal and external combustion engines, classification and applications of I.C. Engines, IC engine components and terminology, four stroke cycle engines and two stroke cycle engines, Assumptions made in air standard cycle, Otto cycle, diesel cycle, dual combustion cycle, comparison of Otto, diesel and dual combustion cycles, Stirling and Ericsson cycles, air standard efficiency, specific work output, specific weight, work ratio, mean effective pressure, deviation of actual engine cycle from ideal cycle, valve and port timing diagrams.

Unit – II

Carburetion: Factors influencing carburetion, mixture requirements for various operating conditions, types of carburettors.

Fuel Injection System: Functional requirements of an injection system, types of inject systems, components of injection system.

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			END SEM University Exam	Two Term Exam	Teachers Assessment*	END SEM University Exam	Teachers Assessment*				
BTAU403	DCC	AUTOMOTIVE ENGINES	60	20	20	30	20	3	0	2	4

Legends: **L** - Lecture; **T** - Tutorial/Teacher Guided Student Activity; **P** – Practical; **C** - Credit;
***Teacher Assessment** shall be based following components: Quiz/Assignment/ Project/Participation in Class, given that no component shall exceed more than 10 marks.

Ignition System: Requirements of ignition system, battery ignition system, magneto ignition system, electronic ignition system, firing order, ignition timing.

Unit – III

Combustion in S.I. engines: Stages of combustion in S.I. engines, effect of engine variables on ignition lag, combustion phenomenon, knock in S.I. engines, effects of engine variables on knock, combustion chamber for S.I. engines.

Combustion in C.I. engines: Stages of combustion in C.I. engines, variables affecting delay period, knock in C.I. engines, C.I. engine combustion chambers.

Unit – IV

Lubrication and Cooling Systems: Functions of a lubricating system, types of lubrication system; mist, wet sump and dry sump systems, crankcase ventilation, properties of lubricant, SAE rating of lubricants, engine performance and lubrication, necessity of engine cooling, effect of engine variables on engine heat transfer, different types of cooling systems.

Unit – V

Performance parameters of IC engines: Engine power, engine efficiencies, mechanical efficiency, brake mean effective pressure and indicative mean effective pressure, torque, specific fuel consumption (BSFC, ISFC), variable affects engine performance, heat balance, engine performance curves.

Engine measurements and Testing: Friction power, indicated power, brake power, fuel and air consumption, speed, temperature of coolant and exhaust, noise and emission measurement.

Pollution and Its Control: Pollutants from S.I. and C.I. engines, Methods of emission control, alternative fuels for I.C. Engines, catalytic convertor.

Text and Reference Books:

1. *"Internal Combustion Engine Fundamentals", by J.B. Heywood, McGraw-Hill, 5th edition.*
2. *"Fundamentals of Internal Combustion Engines", by Paul W. Gill & James H. Smith, Oxford & IBH Pub. Ltd., 4th edition.*

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COURSE CODE	CATEGORY	COURSE NAME	TEACHING &EVALUATION SCHEME								
			THEORY			PRACTICAL		L	T	P	CREDITS
			END SEM University Exam	Two Term Exam	Teachers Assessment*	END SEM University Exam	Teachers Assessment*				
BTAU403	DCC	**AUTOMOTIVE ENGINES**	60	20	20	30	20	3	0	2	**4**

Legends: **L** - Lecture; **T** - Tutorial/Teacher Guided Student Activity; **P** – Practical; **C** - Credit;
***Teacher Assessment** shall be based following components: Quiz/Assignment/ Project/Participation in Class, given that no component shall exceed more than 10 marks.

3. *"A Course in Internal Combustion Engines", by V. M. Domkundwar, Dhanpat Rai Publication, 3rd edition.*
4. *"Internal Combustion Engines", by V. Ganesan, Tata McGraw-Hill, 2nd edition.*
5. *"Internal Combustion Engines", by M.L. Mathur & R.P. Sharma, Dhanpat Rai Publications, 4th edition.*
6. *"A Textbook of Internal Combustion Engines" by R.K. Rajput; Publisher: Laxmi Publications, 2022.*
7. *"Fundamentals of Internal Combustion Engines" by H.N. Gupta; Publisher: PHI Learning, 2023.*
8. *"Engineering Fundamentals of the Internal Combustion Engine" by Willard W. Pulkrabek; Publisher: Pearson, 3rd Edition, 2022.*
9. *"Advances in IC Engines and Combustion" by S. K. Aggarwal; Publisher: Springer, 2023.*
10. *"Performance and Emission Characteristics of Biofuel Blends in IC Engines" by R. Prasad; Publisher: Elsevier, 2022.*
11. *"Combustion and Emissions in IC Engines" by D.F. Lancaster & A.M. Dean; Publisher: CRC Press, 2022.*

List of Experiments

1. To study the working of 2 stroke and 4 stroke petrol (S.I.) engine
2. To study the working of 2 stroke and 4 stroke diesel (C.I.) engine
3. To study valve/port timing diagram of I.C. Engines.
4. To study fuel injection and ignition system of both S.I. & C.I. engines.
5. To study the construction and working of different types of carburetors.
6. To study the different lubrication systems of I.C. engine.
7. To Study of combustion stages of SI Engine & CI engines.
8. Performance analysis of 4-stroke C.I. & SI engine at Different Nozzle Pressure.
9. Performance analysis of 4-stroke C.I. & SI engine at Different CR.
10. Performance analysis of 4-stroke C.I. & SI engine at Different RPM.
11. Performance analysis of 4-stroke C.I. & SI engine at Valve Timings.
12. Performance & Emission analysis of Diesel Engine using various blends of Bio – Fuels.

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			THEORY			PRACTICAL		L	T	P	CREDITS
			END SEM University Exam	Two Term Exam	Teachers Assessment*	END SEM University Exam	Teachers Assessment*				
BTME501A	DSE	CAD CAM CIM	60	20	20	30	20	3	0	2	4

Legends: **L** - Lecture; **T** - Tutorial/Teacher Guided Student Activity; **P** – Practical; **C** - Credit;
***Teacher Assessment** shall be based following components: Quiz/Assignment/ Project/Participation in Class, given that no component shall exceed more than 10 marks.

Course Educational Objectives (CEOs):

This course provides a fundamental understanding of (A) The Design concepts with the help of computer Application (B) Comprehensive Knowledge of computer applications including geometric, Modeling, Assemblies and Manufacturing.

Course Outcomes (COs):

After completion of this course the students are expected to be able to demonstrate following knowledge, skills and attitudes

1. Understand the various design concepts with the help of computer application.
2. Familiarized with the computer graphics application in design and understand the basic 2D & 3D commands of CAD and distinguish the CAD from manual paper drafting, in current industrial & product development scenarios.
3. Understand the solid modeling and assembly tools to develop virtual product and part programming and CIM.
4. Understand the CIM and Group Technology and their importance.

Syllabus

Unit – I **(9 Hrs)**

Introduction: Introduction to CAD, Why CAD Software, Scope, objective, benefit, limitation & evaluation; Engineering Design process, Considerations, Formulation Importance, Regulatory and social issues in Indian context; Conceptual Design, Product Design Cycle, Total life cycle and Digital Prototyping.

Unit – II **(9 Hrs)**

Graphics Fundamentals & Standards: Definition, Software configuration of a Graphic system, Functions of a Graphics package, CAD Interface, coordinate system, Creating Basic Drawings, Creating Additional Drawing Objects, Altering Objects, Drawing Organization and Inquiry Commands, Modify and Manipulating Objects, Construction and Reference Geometry, Hatching Objects, Utility Commands, Layers& Blocks, Text, Table & Dimensions, Introducing Printing, Plotting, and Layouts. Database for graphic modeling; PDM, PIM, EDM; define EDM, features of EDM need for CAD data standardization, data exchange formats; GKS, PHIGS, CORE, IGES, DXF STEP DMIS AND VDI; ISO standard for data exchange.

Unit – III **(9 Hrs)**

Geometric Modeling & Assembly: Introduction to Geometric Modeling, Types of models, Construction of

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COURSE CODE	CATEGORY	COURSE NAME	TEACHING &EVALUATION SCHEME								
			THEORY			PRACTICAL		L	T	P	CREDITS
			END SEM University Exam	Two Term Exam	Teachers Assessment*	END SEM University Exam	Teachers Assessment*				
BTME501A	DSE	CAD CAM CIM	60	20	20	30	20	3	0	2	4

Legends: **L** - Lecture; **T** - Tutorial/Teacher Guided Student Activity; **P** – Practical; **C** - Credit;
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3D Solid Primitives, create 3D Solids from Objects, Extrude, Revolve, Sweep, Loft, Combine or Slice 3D Objects, Move Rotate & Scale 3D Objects, Object Sectioning. Wire frame Models, Curve Representation. Assembly Modeling, Mating conditions, Generation of assembling sequences, basics of boundary presentation- Spline, Bezier, B-Spline, and NURBS; Sculpture and Ruled surfaces, Precedence diagram, Liaison-sequence analysis; Mechanical tolerance: Tolerance concepts, Geometric tolerance, Types of geometric tolerances.

Unit – IV **(9 Hrs)**

Computer-Aided Manufacturing & Part Programming: Computer-Aided Manufacturing, Computer Applications in a Manufacturing Plant, Key Aspects of CAM in a Manufacturing System and Manufacturing Control, G Code & M Code generation through CAD CAM software, Feature Technology, NC, DNC, CNC, NC machine tools: Types of NC machine tools, Automatic tool changes (ATC), Turning centers. ISO codes for turning tools and holders; time and power estimation in milling, drilling and turning.

Unit-V **(9 Hrs)**

Computer Integrated Manufacturing and Group Technology: Introduction to CIM, Scope of Computer integrated Manufacturing; CIM Wheel; Types of Manufacturing systems; Machine tools and related equipment, Material handling systems; Computer control systems, FMS. Importance of batch and job shop production; merits of converting zigzag process layout flow to smooth flow in cellular layout, Production Flow Analysis (PFA) and clustering methods; concept of part families and coding; hierarchical, attribute and hybrid coding; OPITZ, MICLASS and DCLASS coding; FMS; material handling robots, Computer Aided Process Planning (CAPP).

Text and Reference Books:

1. *"Automation, production systems, and computer-integrated manufacturing" by M. P. Groover, Prentice Hall Press, 2007.*
2. *"CAD/CAM/CIM" by P. Radhakrishnan, Subramanian S and Raju V; New Age Pub., 2008.*
3. *"Computer integrated manufacturing: from fundamentals to implementation" by A. Weatherall; Butterworth-Heinemann, 2013.*
4. *"Principles of CIM" by S. Kant Vajpay; PHI, 1995.*
5. *"CAD/CAM" by P.N. Rao, TMH, 2010.*

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Choice Based Credit System (CBCS) Scheme in light of NEP-2020

B. Tech in Mechanical Engineering

(2023-2027)

COURSE CODE	CATEGORY	COURSE NAME	TEACHING &EVALUATION SCHEME								
			THEORY			PRACTICAL		L	T	P	CREDITS
			END SEM University Exam	Two Term Exam	Teachers Assessment*	END SEM University Exam	Teachers Assessment*				
BTME501A	DSE	CAD CAM CIM	60	20	20	30	20	3	0	2	**4**

Legends: **L** - Lecture; **T** - Tutorial/Teacher Guided Student Activity; **P** – Practical; **C** - Credit;
***Teacher Assessment** shall be based following components: Quiz/Assignment/ Project/Participation in Class, given that no component shall exceed more than 10 marks.

6. *"CAD/CAM Computer Aided Design and Manufacturing" by Mikell P. Groover and Emory W. Zimmer, 2008.*
7. *"Computer Integrated Design and Manufacturing" by David D. Bedworth, Mark R. Henderson, Philip M. Wolfe, McGraw-Hill, 1991.*
8. *"Mastering CAD", by George Omura with Brian Benton Autodesk, 2004.*
9. *"PTC Creo Parametric 3.0 for Designers" byTickoo S, Textbooks Published by BPB, 2015.*
10. *"SOLIDWORKS 2017 for Designers", by Tickoo S, Textbooks Published by BPB, 2017.*

List of Experiments

The students will be required to carry out the following exercises using educational software (Auto CAD, Creo, Solid works, Master CAM etc).

1. To set up the drawing environment by configuring drawing limits, units, layers, line types, and saving the file in .dwg format using AutoCAD.
2. To prepare the 2D layout of a building using multiple layers and line colors, indicating all building details, adding text annotations, and creating a title block.
3. To draw orthographic projections (front, top, and side views) of standard mechanical components such as a safety valve, knuckle joint, cotter joint, and Plummer block.
4. To generate an isometric drawing with proper dimensions from given orthographic views.
5. To draw various types of bolts and nuts with internal and external threads (Acme and square), and save them as blocks for reuse.
6. To create 3D models using commands such as extrude, revolve, sweep, loft, and other 3D modeling tools.
7. To prepare assembled 3D CAD models of knuckle joint, cotter joint, and Plummer block using any software.
8. To apply motion constraints and simulate mechanisms such as a four-bar chain and piston-cylinder assembly using any CAD tools.
9. To generate G-codes and M-codes for any 3D model using the CAM module of any CAD software.
10. To write a CNC part program using standard G and M codes for machining a given workpiece.

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B. Tech in AU/ME/CE/EE/EEE/EC/EC-IOT/EI/R&A/MT

(2023-2027)

COURSE CODE	CATEGORY	COURSE NAME	TEACHING &EVALUATION SCHEME								
			THEORY			PRACTICAL		L	T	P	CREDITS
			END SEM University Exam	Two Term Exam	Teachers Assessment*	END SEM University Exam	Teachers Assessment*				
BTME510	AESE	DESIGN THINKING AND INNOVATION	60	20	20	0	0	2	0	0	**2**

Legends: **L** - Lecture; **T** - Tutorial/Teacher Guided Student Activity; **P** – Practical; **C** - Credit;
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Course Educational Objectives (CEOs):
The objective of this course is to provide (A) the new ways of creative thinking and learn the innovation cycle of design thinking process, (B) understand product design and prototyping and (C) develop innovative product.

Course Outcomes (COs):
After completion of this course student will able to

1. To apply learning styles and memory techniques in engineering education.
2. To analyze emotions for designing user-centered products.
3. To use creative thinking and design thinking for innovation.
4. To propose and develop real-time innovative product prototypes.
5. To understand individual differences and enhance customer experience.

Syllabus

Unit I **(6 Hrs)**

Learning: understanding the learning process, Kolb's learning styles, assessing and interpreting.
Memory: understanding the memory process, problems in retention, memory enhancement techniques.
Emotions: understanding emotions, experience & expression, assessing empathy, application with peers.

Unit II **(6 Hrs)**

Design Thinking: definition, need, objective, concepts & brainstorming, stages of design thinking process (explain with examples) – empathize, define, ideate, prototype, test.
Creative Thinking: understanding creative thinking process, understanding problem solving, creative problem-solving test.

Unit III **(6 Hrs)**

Product Design: process of engineering product design, design thinking approach, stages of product design, examples of best product designs and functions, assignment – engineering product design.

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Prototyping: What is prototype? Why prototype? Rapid prototype development process, testing, sample example, test group marketing

Unit IV **(6 Hrs)**

Celebrating the Difference: understanding individual differences & uniqueness, group discussion and activities to encourage the understanding, acceptance and appreciation of individual differences
Customer Centricity: practical examples of customer challenges, use of design thinking to enhance customer experience, parameters of product experience, alignment of customer expectations with product design.

Unit V **(6 Hrs)**

Feedback, Re-design & Re-create: feedback loop, focus on user experience, address "ergonomic challenges, user focused design, rapid prototyping & testing, final product, final presentation – **"solving practical engineering problem through innovative product design & creative solution".**

Text and Reference Books:

1. *E. Balaguruswamy "Developing Thinking Skills (The way to Success)" Khanna Book Publishing Company, 2022.*
2. *Gavin Ambrose and Paul Harris "Basics Design 08: Design Thinking" Bloomsbury Publishing India Pvt. Ltd. 2009.*
3. *Vijay Kumar "101 Design Methods: A Structured Approach for Driving Innovation in Your Organization" Wiley Pub. 2012.*
4. *Idris Mootee, "Design Thinking for Strategic Innovation: What They Can't Teach You at Business or Design School", John Wiley & Sons 2013.*
5. *Hasso Plattner, Christoph Meinel and Larry Leifer (eds), "Design Thinking: Understand – Improve – Apply", Springer, 2011*
6. *Roger Martin, "The Design of Business: Why Design Thinking is the Next Competitive Advantage", Harvard Business Press, 2009.*

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B. Tech in Automobile Engineering
(2023-2027)

COURSE CODE	CATEGORY	COURSE NAME	TEACHING &EVALUATION SCHEME								
			THEORY			PRACTICAL		L	T	P	CREDITS
			END SEM University Exam	Two Term Exam	Teachers Assessment*	END SEM University Exam	Teachers Assessment*				
BTAU508	DCS	VEHICLE MAINTENANCE RECONDITIONING LAB	0	0	0	0	50	0	0	2	**1**

Legends: **L** - Lecture; **T** - Tutorial/Teacher Guided Student Activity; **P** – Practical; **C** - Credit;
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Course Educational Objectives (CEOs)

To knowledge of (A) Maintenance and Safety, Engine Subsystem, (B) Clutch, Steering, Brake, suspension, (C) Wheel, Air Conditioning and Electrical Components.

Course Outcomes (COs)

After completion of this course the students are expected to be able to demonstrate following knowledge, skills and attitudes

1. Students would be able to understand the need of maintenance and safety.
2. Students would be able to understand about maintenance of engine subsystem.
3. Students would be able to understand transmission and driveline, i.e. propeller shaft, rear axle etc.
4. Students will be able to understand the maintenance of steering, brakes and wheel.
5. Students would be able to understand automobile safety and their need.
6. Students would be able to understand the maintenance of air conditioning and electrical components.

Syllabus

Unit I

Introduction of Maintenance: Maintenance need, importance, primary and secondary functions; classification of maintenance work; vehicle insurance; basic problem diagnosis, automotive service procedures, workshop operations vehicle maintenance; vehicle identification.
Safety: personnel safety, machines and equipment safety, vehicles, fire safety - first aid; basic tools – special service tools – measuring instruments; condition checking of seals, gaskets and sealants; scheduled (preventive) maintenance, unscheduled (breakdown) maintenance; service intervals - towing and recovering, reports, log sheets, trip sheets and other forms.

Unit II

Maintenance of Engine Subsystem: General engine service, dismantling of engine components, engine repair, working on the underside, front, top, ancillaries service of basic engine parts;

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cooling and lubricating system; fuel system, intake and exhaust system; electrical system, electronic fuel injection and engine management service; fault diagnosis; emission controls.

Unit III

Transmission and Driveline Maintenance: General checks, adjustment and service dismantling, identifying, checking and reassembling transmission, removing and replacing propeller shaft; servicing of cross and yoke joint and constant velocity joints; rear axle service, points removing axle shaft and bearings; servicing differential assemblies error diagnosis.

Unit IV

Steering: maintenance and service of steering linkage, steering column, rack and pinion steering, recirculating ball steering service; worm type steering, power steering system.
Brake: maintenance and service of hydraulic brake, drum brake, disc brake, parking brake, bleeding of brakes.
Suspension: maintenance and service of coil spring, leaf spring, shock absorbers; dismantling and assembly procedures.
Wheel: wheel alignment and balance; removing and fitting of tyres; tyre wear and tyre rotation.

Unit V

Air Conditioning: maintenance of air conditioning parts like compressor, condenser, expansion valve, evaporator, replacement of hoses, leak detection, AC charging, fault diagnosis; body repair like panel beating, tinkering, soldering, polishing, painting.
Electrical Components: Maintenance of batteries, starting system, charging system and body electrical -fault diagnosis using scan tools.

Reference Books:

1. *"Automotive Mechanics" by Ed May, Volume 1 and 2, McGraw Hill Publications, 2003*
2. *"Fleet Management" by John Doke, McGraw Hill Co., 1984*

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3. *"Engineering: Lightweight", by Brian Cantor, Patrick Grant, Colin Johnson Automotive Functional, and Novel Materials, Taylor and Francis, 2008.*
4. *"Automobile and Mechanical Electrical Systems", by Tom Denton, Butterworth-Heinemann, 2011.*
5. *"The Automobile Chassi", by Jornsen Reimpell Helmut Sto; Engineering Principles, Jurgen Betzler (P) Ltd, 2nd Ed., 2001.*

List of Experiments

1. Study of cylinder re-boring-checking the cylinder bore.
2. Study of valve grinding, valve lapping.
3. Setting the valve angle and checking for valve leakage
4. Calibration of fuel injection pump
5. Wheel alignment – testing of camber, caster
6. Testing kingpin inclination, toe-in and toe-out
7. Chassis alignment testing
8. Brake adjustment and brake bleeding.
9. Head light adjustment.
10. Tyre changing.
11. Wheel balancing.

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