ST. VINCENT PALLOTTI COLLEGE OF ENGINEERING & TECHNOLOGY, NAGPUR

(An autonomous institution affiliated to Rashtrasant Tukadoji Maharaj Nagpur University)

M.Tech. Scheme of Examination & Syllabus 2026-27

AUTOMOTIVE TECHNOLOGY

SEMESTER I

Sr No.	Course Category	CourseCode	Course Title	Hoursper Week			Credits	Maximum Marks			Min Passing marks	No. of Hrs for ESE
				L	T	P		Continual Assessment	End Sem Examination	Total		
1.	PCC	26AT101T	Automotive Mechanical Systems	4	-	-	4	40	60	100	50	3
2.	PCC	26AT101P	Automotive Mechanical Systems Lab	-	-	2	1	25	25	50	25	-
3.	PCC	26AT102T	Automotive Electrical and Electronics Systems	4	-	-	4	40	60	100	50	3
4.	PCC	26AT102P	Internal Combustion Engines Lab	-	-	2	1	25	25	50	25	-
5.	PCC	26AT103T	Vehicle Dynamics	4	-	-	4	40	60	100	50	3
6.	PEC	26AT104T	Program Elective-I	4	-	-	4	40	60	100	50	3
7.	PEC	26AT105T	Program Elective-II	4	-	-	4	40	60	100	50	3
8.	CEP	26AT106P	Technical Seminar & Research paper Writing	-	-	2	1	50	-	50	25	-
Total				**20**	**0**	**06**	**23**	**300**	**350**	**650**		

Chairman - BoS	Dean – Academics	July 2026 Date of Release	1.0 Version	Applicable for 2026-27

Basket for Program Elective – I Courses

Semester	Course Category	Course Code	Name of Course	Credits
I	PEC	26AT104T(i)	Automotive Fuels & Emissions	4
I	PEC	26AT104T(ii)	Machinery Fault diagnosis	4
I	PEC	26AT104T(iii)	Vehicle and Engine Testing	4

Basket for Program Elective – II Courses

Semester	Course Category	Course Code	Name of Course	Credits
I	PEC	26AT105T (i)	Advanced Materials Engineering	4
I	PEC	26AT105T (ii)	Artificial Intelligence in Automobiles	4
I	PEC	26AT105T (iii)	Noise, Vibration & Harshness	4

FIRST SEMESTER

Course Code	Course Name	Th	Tu	Pr	Credits	Evaluation		
						CA	ESE	Total
26AT101T	Automotive Mechanical Systems	4	-	-	4	40	60	100

Course Objectives	Course Outcomes
1. To familiarize vehicle architecture, including chassis and suspension systems, and internal combustion engine operation. 2. To demonstrate steering systems, wheel alignment, and suspension tuning for optimal performance. 3. To explore transmission types and braking principles, including hydraulic systems and advanced technologies. 4. To provide an overview of automotive electrical systems, drivetrain layouts, and safety systems.	1. Identify and explain vehicle components and configurations. 2. Analyze and adjust steering and suspension for improved vehicle handling. 3. Understand transmission types and assess braking systems. 4. Acquire knowledge of electrical systems and safety features in automotive contexts.

Unit I	**[12 Hrs]**
Introduction to Vehicle subsystems: Introduction to vehicle architecture, Chassis types and construction, Suspension types and components, Internal combustion engine operation, Engine types and configurations, Air standard cycles, engine components and their functions, Engine cooling and lubrication systems.	
Unit II	**[12 Hrs]**
Steering systems and their operation: Wheel Alignment, Steering Linkage, Power Assisted Steering Operation, Alignment, Suspension System Components and Operation, Front and rear suspension.	
Unit III	**[12 Hrs]**
Transmission types and operation: Clutch-single plate, multi-plate, Dual clutch, Gearbox Sliding mesh, constant mesh, synchromesh gearboxes and differential components - Automatic and Hybrid Drives - Continuously Variable Transmissions.	
Unit IV	**[12 Hrs]**
Principles of braking: Brake types and components, Drum and Disc Brakes, Hydraulic Systems, Anti-lock braking systems (ABS) and electronic brake force distribution (EBD), Automotive safety systems, Active and Passive safety, Overview of testing and homologation standards.	
Unit V	**[12 Hrs]**
Automotive electrical system: Battery operation, types and maintenance, Charging and starting systems, Electrical circuits and wiring in vehicles, Lighting and signaling systems. Drivetrain layout and power distribution, Hybrid and electric powertrain technologies.	

Text Books

S.N.	Title	Authors	Edition	Publisher
1.	Vehicle and Engine Technology	Heinz Heisler	2010	Butterworth-Heinemann
2.	Automobile Engineering	S.K. Gupta	2020	S.Chand Publishing, 2nd edition,

Reference Books

S.N.	Title	Authors	Edition	Publisher
1.	Automobile Mechanical and Electrical Systems	Tom Denton and Hayley Pells	Third Ed. 2023.	Routledge
2.	Internal Combustion Engine Fundamentals	Heywood J B	2017	McGraw-Hill

FIRST SEMESTER

Course Code	Course Name	Th	Tu	Pr	Credits	Evaluation		
						CA	ESE	Total
26AT101P	Automotive Mechanical Systems Lab	-	-	2	1	25	25	50

Course Objectives	Course Outcomes
1. To familiarize vehicle architecture, including chassis and suspension systems, and internal combustion engine operation. 2. To demonstrate steering systems, wheel alignment, and suspension tuning for optimal performance. 3. To explore transmission types and braking principles, including hydraulic systems and advanced technologies. 4. To provide an overview of automotive electrical systems, drivetrain layouts, and safety systems.	Course Outcome: 1. Demonstrate the significance of experimentation and explore the possibility of carrying out engineering investigations. 2. Acquire hands-on experience on the various test rigs, and experimental setups. 3. Measure the various technical parameters by instruments 4. Identify the effect of various parameters on the system and co-relate them. 5. Understand the selection of fuel on the basis of power output, emission norms, engine size and applications.

Minimum 8 experiments to be performed

Expt. No.	Title of the experiment
1	Heat Rejection test (heat balance sheet) on a diesel engine.
2	Performance test on diesel and petrol engines.
3	Assessment of engine friction loss by Willian line method
4	Emission test on petrol engine with Eddy Current Dynamometer
5	Emission test on Heavy duty diesel engine on rope brake dynamometer
6	Quality analysis of biodiesel at different mixing rates and temperatures
7	Chemical characterization of Gasoline fuel
8	Chemical characterization of Diesel fuel
9	Demonstration of various noise and vibration measuring instruments
10	Measurement of Sound pressure level of automotive noise sources
11	Noise measurement of an electric motor
12	Vibration measurement of an electric motor

Text Books

S.N.	Title	Authors	Edition	Publisher
1.	Internal Combustion Engines	Ganesan. V	2017	Mc Graw Hill Education
2.	Internal Combustion Engine Fundamentals	John B Heywood	2017	Mc Graw Hill Education

Reference Books

S.N.	Title	Authors	Edition	Publisher
1.	Engine Testing: Theory and Practice	Martyr, A. J., Plint, M. A.	2012	Butterworth Heinemann
2,	Fundamentals of Noise and Vibration Analysis for Engineers	Norton Michael, Karczub Denis	2003	Cambridge University Press

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AUTOMOTIVE TECHNOLOGY

FIRST SEMESTER

Course Code	Course Name	Th	Tu	Pr	Credits	Evaluation		
						CA	ESE	Total
26AT102T	Automotive Electrical & Electronics Systems	4	-	-	4	40	60	100

Course Objectives	Course Outcomes
1.To impart basic knowledge of vehicle electrical and electronic systems to the student. 2. To develop an understanding on the power generation, storage and utilization processes involved in the vehicle. 3. To bring an understanding on the communication and networking among the electrical and electronic systems in the vehicle. 4. To enable the students to investigate and design the sensing and actuation processes involved in the vehicle.	1. Describe the working of charging and starting systems 3. Gain the knowledge and skills of the automotive wiring design and ignition system 2. Acquiring the sensing technique and working of automotive sensors 3. Explain d the working of engine management system and other electronic control unit in the vehicle 4. Gain the skills on the recent development in the area of automotive electronic and electrical systems 5. Distinguish various accessories and onboard instrumentation system and examine their role in automotive performance.

Unit I **[12 Hrs]**

Starting and Charging System and Electric Drives

Requirements of Starter Motor, Starter Motor types, construction and characteristics, Starter drive mechanisms, Starter Switches and Solenoids. - Charging system components, Generators and Alternators, types, construction and Characteristics, Voltage and Current Regulation, Cut –out relays and regulators.

Unit II **[12 Hrs]**

. W**iring and Lighting System**

Automotive Wiring Harnesses, Insulated and Earth Return System, Positive and Negative Earth Systems, Connectors and its types, Head Lamp and Indicator Lamp construction and working details, focusing of head lamps, Anti–Dazzling and Dipper Details.

Unit III **[12 Hrs]**

Sensors and Actuators

Engine sensors and actuator: Manifold Absolute Pressure sensor, knock sensor, Coolant and Exhaust gas temperature, Exhaust Oxygen level sensor, Throttle position sensor, accelerator pedal position sensor and crankshaft position sensor, Air mass flow sensor. Solenoids, stepper motors and relays, piezo actuators. Chassis: - Steering wheel angle sensor, Vibration and acceleration sensors, Pressure sensors, Speed and RPM sensors, torque sensors.

Unit IV **[12 Hrs]**

Electronic Engine Management System

Electronics Fuel Injection, Types of EFI, TBI, MPFI & GDI, Microprocessor And Microcomputer controlled devices in automobiles, Architecture of an ECU, Electronic engine control: Input, output devices, electronic fuel control system, engine control operating modes, electronic ignition systems, and Spark advance correction schemes.

Automotive Tools, Diagnosis: tools and equipment, Oscilloscope,onboard diagnosis system, Electromagnetic compatibility & tests for EMC.

Unit V **[12 Hrs]**

Electric Management System and Dash Board Instrumentation

Cruise control system, Antilock braking system, traction control system, electronic suspension system, electronic steering control, transmission control, Airbags, collision avoiding system, low tire pressure warning system. Warning system, driver information .instrument cluster ECU, types of indication in the cluster, Bus system, CAN and LIN communication, Horns, wiper system and its types, keyless entry system.

Text Books

S.N.	Title	Authors	Edition	Publisher
1.	Automobile Electrical and Electronic systems	Tom Denton	(2017), 5th Edition	Taylor & Francis Group Rouletedge
2.	Automotive electricity and electronics	J. D. Halderman, and C. D. Mitchell	(2005) 6th Edition	Pearson/Prentice Hall

Reference Books

S.N.	Title	Authors	Edition	Publisher
1.	Automotive Hand Book	Robert Bosch	(2010) 5th Edition),.	SAE
2.	Automobile Electrical Equipment"	Crouse,W.H	3rd edition,reprint 2010	McGraw-HillBookCo., Inc.,NewYork

		July 2026	1	Applicable for 2026-27
Chairman - BoS	Dean – Academics	Date of Release	Version	

FIRST SEMESTER

Course Code	Course Name	Th	Tu	Pr	Credits	Evaluation		
						CA	ESE	Total
26AT102P	Internal Combustion Engines Lab	-	-	2	1	25	25	50

Course Objectives	Course Outcomes
1. Determine engine performance characteristics for IC Engine by Applying thermo - chemical principles of energy and chemical balances through appropriate modeling. 2. Identify engineering problems, formulate model and solve the problems using knowledge of mathematics science and engineering. 3. Learn about advanced concepts being pursued for modeling of IC Engine.	1. Demonstrate the significance of experimentation and explore the possibility of carrying out engineering investigations 2. Acquire hands on experience on the various test-rigs, experimental set up 3. Measure the various technical parameters by instrument and by mathematical relationship 4. Validate actual performance of the system experimentally 5. Analyse experimental test data for further improvement of the system 6. Understand selection of fuel on basis of power output, emission norms, engine size and applications

Minimum 8 experiments to be performed

S.No.	Title of the Experiment
1	Performance analysis of single cylinder spark ignition research engine to study effect of various compression ratios.
2	Performance analysis of single cylinder spark ignition research engine to study effect of ignition timing.
3	Performance analysis of single cylinder spark ignition research engine to study effect of exhaust gas re-circulation.
4	Performance analysis of single cylinder compression ignition research engine to study effect of various compression ratios.
5	Performance analysis of single cylinder compression ignition research engine to study effect of ignition timing.
6	Performance analysis of single cylinder compression ignition research engine to study effect of exhaust gas re-circulation.
7	Preparation of bio-diesel and its blends.
8	Effect of fuel blending on the performance of internal combustion engine.
9	Performance analysis of open and closed ECU using single cylinder research engine.
10	Performance analysis of hydrogen as a fuel using single cylinder research engine.

Text Books

S.N.	Title	Authors	Edition	Publisher
1.	Internal Combustion Engine Fundamentals	Heywood J B	2017	McGraw-Hill
2.	Vehicle and Engine Technology	Heinz Heisler	2010	McGraw-Hill

Reference Books

S.N.	Title	Authors	Edition	Publisher
1.	ECE & EC Regulations/Standards	--	--	GOI
2.	Safety Regulations- Society of Indian Automobile Manufacturers	--	--	AIS

FIRST SEMESTER

Course Code	Course Name	Th	Tu	Pr	Credits	Evaluation		
						CA	ESE	Total
26AT103T	Vehicle Dynamics	4	-	-	4	40	60	100

Course Objectives	Course Outcomes
1. To make the student establish the role of the vehicle dynamics and various parameters in the design and performance evaluation. 2. To enable the students to demonstrate the vehicle motion and analyze the vehicle response for various driving conditions. 3. To make the student to evaluate the performance characteristics of vehicle dynamics under various driving conditions	Student will be able to 1. Explain the dynamics of the automotive systems and its performance parameters. 2. Identify the driving/ braking resistances and their influences on vehicle dynamics. 3. To analyze dynamics systems such as suspension systems, body vibrations, steering mechanisms. 4. Correlate the vehicle dynamics and ride characteristic of vehicle.

Unit I	**[12 Hrs]**
Vehicle Dynamics Introduction: Introduction to vehicle dynamics - Dynamics of the motor vehicle, Vehicle fixed coordinates system, Earth fixed coordinates system, Details of vehicle systems, wheel angles, Typical data of vehicles. Load distribution – calculation of CG of a vehicle – Effect of CG on vehicle performance.- Basic equation of Acceleration.	
Unit II	**[12 Hrs]**
.**Aerodynamic forces on vehicle:** Aerodynamic forces on ground vehicles - Wheel load - traction due to Aerodynamic forces - safety, performance characteristics –Problems-Three dimensional effects - Design features to reduce drag. Computational analysis and kinematic and force analysis of systems	
Unit III	**[12 Hrs]**
Longitudinal dynamics - Forces and moments on vehicle, Equation of motion, Tire forces, rolling resistance, weight distribution, Tractive effort and Power available from the engine, Calculation of Maximum acceleration Braking torque, Braking Force, Brake Proportioning, Braking Efficiency, Stopping Distance, Prediction of Vehicle performance. ABS, stability control, Traction control.	
Unit IV	**[12 Hrs]**
Lateral Dynamics - Steering geometry, Types of steering systems, Fundamental condition for true Rolling, Development of lateral forces. Steady state handling characteristics. Yaw velocity, Lateral Acceleration, Curvature response & directional stability.	
Unit V	**[12 Hrs]**
. Vertical Dynamics - Human response to vibrations, Sources of Vibration, Suspension systems, Functions of suspension system. Body vibrations: Bouncing and pitching. Doubly conjugate points. Body rolling. Roll center and roll axis, Stability against body rolling.	

Text Books

S.N	Title	Authors	Edition	Publisher
1.	Fundamentals of Vehicle Dynamics	Thomas D. Gillespie	2013	Society of Automobile Engineers Inc
2.	Vehicle dynamics and control	Rajesh Rajamani	2012	Springer publication.

Reference Books

S.N	Title	Authors	Edition	Publisher
1.	Vehicle Dynamics : Theory and Application.	Reza N Jazar	2009	Springer publication
2	Race Car Vehicle Dynamics	William F. Milliken and Douglas L. Milliken	2013	

FIRST SEMESTER

Course Code	Course Name	Th	Tu	Pr	Credits	Evaluation		
						CA	ESE	Total
26AT104T(i)	PE – I Automotive Fuels and Emissions	4	-	-	4	40	60	100

Course Objectives	Course Outcomes
1. To enable to use various automotive fuels, their properties, and production processes. 2. To enable to comprehend combustion mechanisms in internal combustion engines. 3. To enable to identify the formation mechanisms of pollutants in engines. 4. To enable to explore emission control technologies and their applications. 5. To enable to familiarize with emission measurement techniques and regulatory standards.	1. Classify automotive fuels and understand their characteristics. 2. Analyze combustion processes in SI and CI engines. 3. Identify and explain pollutant formation mechanisms. 4. Evaluate various emission control technologies. 5. Apply knowledge of emission measurement methods and comprehend regulatory frameworks.

Unit I	**[12 Hrs]**
Fuels for Internal Combustion Engines Classification and properties of automotive fuels.Alternative fuels: Hydrogen, alcohols, biodiesel, LPG, CNG, LNG.Fuel production processes: Cracking, reforming, gasification.Impact of fuel additives.	
Unit II	**[12 Hrs]**
Combustion in Internal Combustion Engines Air-fuel ratio calculations and stoichiometry.Combustion processes in SI and CI engines.Flame propagation, knocking, and factors affecting combustion efficiency.Heat release analysis and thermodynamic aspects.	
Unit III	**[12 Hrs]**
Pollutant Formation in Engines Formation mechanisms of HC, CO, NOx, particulate matter, and SOx emissions.Influence of engine operating conditions on emissions.Effect of fuel composition on pollutant formation.	
Unit IV	**[12 Hrs]**
Emission Control Technologies Exhaust after-treatment systems: Catalytic converters, selective catalytic reduction (SCR), diesel particulate filters (DPF).Role of exhaust gas recirculation (EGR).Fuel injection strategies for emission reduction.Modern engine technologies: Gasoline direct injection (GDI), homogeneous charge compression ignition (HCCI), reactivity controlled compression ignition (RCCI).Overview of emission norms and compliance (e.g., BS-VI, Euro standards).	
Unit V	**[12 Hrs]**
. Emission Measurement and Regulations Emission measurement techniques: Non-dispersive infrared (NDIR), flame ionization detector (FID), chemiluminescence. On-board diagnostics (OBD) and in-use vehicle testing.Global and Indian emission standards and regulatory frameworks	

Text Books

S.N	Title	Authors	Edition	Publisher
1.	Internal Combustion Engines	Ganesan, V	4th ,2017	,Tata McGraw-Hill Education
2.	Internal Combustion Engine	Heywood, J.B	2017	McGraw-Hill Education.

Reference Books

S.N	Title	Authors	Edition	Publisher
1.	Introduction to Internal Combustion Engines	Stone, R.	2012	Palgrave Macmillan.
2	Engineering Fundamentals of the Internal Combustion Engine	Pulkrabek, W.W	2003	Pearson Education.
3	Internal Combustion Engines and Air Pollution	Obert, E.F	11273	Harper & Row

FIRST SEMESTER

Course Code	Course Name	Th	Tu	Pr	Credits	Evaluation		
						CA	ESE	Total
26AT104T(ii)	PE – I Machinery Fault Diagnosis	4	-	-	4	40	60	100

Course Objectives	Course Outcomes
1. To enable the student to understand the basics of Condition Monitoring Techniques (CBM) which would give insight into machine fault finding in mechanical components. 2. To enable the student to select appropriate instrumentation for CBM. 3. To enable the student to analyzed signals sensed by the instrumentation using appropriate signal processing techniques. 4. To enable the student to explore the research prospect in the area of CBM.	1. To identify and distinguish between the types of machinery failure 2. To select appropriate maintenance strategy for machine condition monitoring. 3. To select appropriate signal processing technique to detect machine fault. 4. To develop data acquisition system for machine fault diagnosis. 5. To analyze signal for determination of presence of fault, location of fault, level of fault severity and remaining useful life of component.

Unit I **[12 Hrs]**

Introduction to machine failures: Machinery failure and types, equipment life cycle, bath tub curve, Causes of failure, ways of preventing equipment failure, , Frequency of failure, various failure mechanism12

Unit II **[12 Hrs]**

Maintenance Strategies: Basic Maintenance Strategies, Maintenance concepts, factors which influence the Maintenance Strategy, concept of Machine Condition Monitoring, Periodic Monitoring, Continuous Monitoring, condition monitoring techniques for fault detection.

Unit III **[12 Hrs]**

Signal Analysis: Classification of signals, Signal generation from various failures (characterization), Data Acquisition, single channel & multi-channel DAQ system, Signal Conditioning and its functions, sampling rate, selection of sampling rate, sampling errors, Nyquist theorem of sampling, Signal Processing, Signal Processing Techniques, Selection of Signal Processing Techniques to detect machine failure, signal analysis in time domain, time domain statistical parameters, signal analysis in frequency domain, Fast Fourier Transform (FFT), wavelet transform, time-frequency analysis, signal analysis softwares.

Unit IV **[12 Hrs]**

Sensors & Transducers: Classification of Sensors, difference between sensor & transducer, sensors for machine fault detection, selection of sensors (frequency), accuracy, static and dynamic characteristics of sensor, sensors for vibration measurement, displacement sensor, velocity pickup, accelerometer, piezo-sensor, acoustic sensors.

Unit V **[12 Hrs]**

Fault Detection: vibration based fault diagnosis, directions of vibrations, Bend pulley failure analysis, rotor imbalance detection, bearing terminology, shaft misalignment detection Bearing Fault, bearing characteristic frequency calculations, gear terminology, Gear Fault, gear mesh frequency calculations Balancing Defects, Shaft Misalignment, bent shaft, looseness, soft foot.

Text Books

S.N	Title	Authors	Edition	Publisher
1.	Vibration-Based Condition Monitoring –Industrial, Aerospace and Automotive applications	Robert Bond Randall	2011	John Wiley & Sons Ltd
2.	Maintenance Engineering and Management	R. C. Mishra, K. Pathak	2002	Prentice Hall of India Pvt. Ltd.

Reference Books

S.N	Title	Authors	Edition	Publisher
1.	Machinery Condition Monitoring Principles and Practices	Dr. Amiya R. Mohanty	2017	CRC Press
2.	An Introduction to Machinery Analysis and Monitoring	John S. Mitchell	11281	Penn Well Books

FIRST SEMESTER

Course Code	Course Name	Th	Tu	Pr	Credits	Evaluation		
						CA	ESE	Total
26AT104T(iii)	PE – I Vehicle and Engine Testing	4	-	-	4	40	60	100

Course Objectives	Course Outcomes
1. To enable to explain the principles and methodologies of vehicle and engine testing. 2. To enable to familiarize with testing standards and homologation procedures. 3. To enable to develop skills to conduct performance, emission, and durability tests. 4. To enable to analyze test data to evaluate vehicle and engine performance. 5. To enable to comprehend the role of simulation tools in testing scenarios.	1. Apply standardized testing procedures for vehicles and engines. 2. Conduct and interpret results from various performance and emission tests. 3. Ensure compliance with national and international testing standards. 4. Utilize simulation tools to predict vehicle and engine behavior. 5. Recommend design or operational modifications based on test outcomes.

Unit I Introduction to Vehicle and Engine Testing **[12 Hrs]**

- Purpose and significance of testing in automotive engineering. Overview of testing facilities and equipment.
- Safety protocols and best practices in testing environments.

Unit II Testing Standards and Homologation **[12 Hrs]**

- Overview of national and international testing standards (e.g., AIS, CMVR, ECE, FMVSS). Homologation processes and certification requirements. Classification and specifications of vehicles (M, N, O categories).

Unit III Engine Testing Procedures **[12 Hrs]**

- Performance testing: Power, torque, and fuel consumption measurements. Emission testing: Pollutant measurement techniques and standards compliance. Durability and reliability assessments. Instrumentation and data acquisition systems for engine testing.

Unit IV Vehicle Testing Techniques **[12 Hrs]**

- Road load data acquisition and analysis. Brake testing: Performance, fade, and recovery tests.
- Handling and stability assessments.Noise, vibration, and harshness (NVH) testing methodologies.

Unit V Simulation and Modeling in Testing **[12 Hrs]**

- Role of simulation tools in vehicle and engine testing. Correlation between simulation results and physical testing.Case studies on the application of simulation in testing scenarios.

Text Books

S.N	Title	Authors	Edition	Publisher
1.	Fundamentals of Vehicle Dynamics	Gillespie, T.D	112122	SAE International
2.	Bosch Automotive Handbook	Robert Bosch	2022	Wiey

Reference Books

S.N	Title	Authors	Edition	Publisher
1.	Engine Testing: Theory and Practice	Martyr, A.J., and Plint, M.A	2007	SAE International
2,	Advanced Vehicle Technology	Heisler, H	2002	Butterworth-Heinemann.

FIRST SEMESTER

Course Code	Course Name	Th	Tu	Pr	Credits	Evaluation		
						CA	ESE	Total
26AT105T(i)	PE– II Advanced Materials Engineering	4	-	-	4	40	60	100

Course Objectives	Course Outcomes
1. To develop fundamentals in selecting appropriate materials for industrial and engineering applications. 2. To compute the mechanical properties of engineering materials using various testing methods. 3. To study the structure and properties of engineering materials. 4. To Study concept to avoid failures with respect to fatigue, creep and fracture.	1. Explain the fundamentals of various engineering materials, properties and their crystal structure. 2. Compute the mechanical properties of engineering materials using tension and torsion testing. 3. Compute the mechanical properties of engineering materials using fatigue testing. 4. Estimate the creep behavior 5. Realize the significance of fracture mechanics.

Unit I **[12 Hrs]**

STRUCTURE AND PROPERTIES: Structure of metals, Defects in crystals, Deformation, Relationship between structure and properties, Mechanical properties of metals, Strain hardening, Strengthening mechanisms.

Unit II **[12 Hrs]**

TENSION AND TORSION: Stress - Strain curve, Measures of yielding, Measures of ductility, Toughness, Flow curve, Effect of temperature on flow properties, Anisotropy, mechanical properties in torsion, Method of measuring shear stress, Types of torsion failures, Torsion test Vs Tension test. Stress –Strain curve of composite materials.

Unit III **[12 Hrs]**

FATIGUE: Fatigue phenomena, Theories of fatigue failure, Evaluation of fatigue resistance, Methods of presenting fatigue data, Fatigue crack propagation, Parameters influencing fatigue, Cyclic stress strain behavior, Design against fatigue, Low cycle fatigue.

Unit IV **[12 Hrs]**

CREEP: Description of creep, Creep curve, Stress-rupture test, Creep mechanisms Dislocation glide, Diffusion flow, Dislocation and Diffusion, Creep in two phase alloys, Deformation Mechanism Maps, Materials aspects creep design, Estimates of creep behavior, Presentation of Engineering creep data Super plasticity.

Unit V **[12 Hrs]**

FRACTURE MECHANICS: Types of fracture, Theoretical strength of a solid, Griffith's Theory, Irwin-Orowan Theory crack propagation Modes, Dislocation Theories of Brittle fracture, Ductile fracture, Analysis of crack propagation, Stress intensity factor, Crack opening displacement, integrals-Fracture toughness measurement methods.

Text Books

S.N	Title	Authors	Edition	Publisher
1.	Engineering Materials and Metallurgy	U. C. Jindal	2011	Pearson
2.	Mechanical Metallurgy	George E. Dieter	11288	McGraw Hill

Reference Books

S.N	Title	Authors	Edition	Publisher
1.	Process of Creep and fatigue of Metals	Kennedy, A. J	11258	Industrial Press,
2	Mechanical Behaviour of Materials	Thomas H. Courtney	2000	McGraw Hill

FIRST SEMESTER

Course Code	Course Name	Th	Tu	Pr	Credits	Evaluation		
						CA	ESE	Total
26AT105T (ii)	PE– II Artificial Intelligence in Automobile	4	-	-	4	40	60	100

Course Objectives	Course Outcomes
1. To make students aware about application of various AI techniques, sensors in automobiles. 2. To give brief overview about importance of AI for vehicle research and development and maintenance.	1. Explain importance of AI in ADAS. 2. Describe use of computer vision in autonomous vehicle. 3. Explain uses of different types of sensors and their fusion for autonomous vehicle. 4. Explain application of AI for vehicle infotainment and research and development. 5. Explain importance of AI for predictive maintenance and services.

Unit I	**[12 Hrs]**
Introduction: Introduction to Artificial Intelligence and Autonomous Vehicles, Need for AI in Advanced Driver Assistance systems (ADAS), AI for Advanced Driver Assistance Systems, Automatic Parking, Traffic Sign Recognition, Driver Monitoring System ,Machine Learning Workflow.	
Unit II	**[12 Hrs]**
Computer vision for Autonomous Vehicles: Sensor and Camera Calibration, Image Classification with Convolutional Neural Networks, Object Detection in Images, Semantic Segmentation in Images, Perception, Planning, Motion Control.	
Unit III	**[12 Hrs]**
Sensor Fusion: Introduction to Perception and Sensor Fusion, The Lidar Sensor, Detecting Objects in Lidar, Kalman Filters, Extended Kalman Filters, Camera-Lidar External Calibration, Multi Sensor Fusion, Multi Object Tracking	
Unit IV	**[12 Hrs]**
AI for Research & Development, Automated Rules Generation, Virtual Testing Platform, And Synthetic Scenario Generation. AI for In-Vehicle Infotainment Systems, Gesture Control, Voice Assistant, User Action Prediction	
Unit V	**[12 Hrs]**
AI for Services, Predictive Diagnostics, Predictive Maintenance, Driver Behavior Analysis. The Future of AI in Cars, A Tale of Two Paradigms , AI & Car Safety, AI & Car Security .	

Text Books

S.N	Title	Authors	Edition	Publisher
1.	AI and Generative AI for Automobile Engineering	Rao S	January 2025	Independently Published ; ISBN: 127128307414705
2.	AI for Cars	Josep Aulinas and Hanky Sjafrie	2022	RC Press is an imprint of Taylor & Francis Group, LLC

Reference Books

S.N	Title	Authors	Edition	Publisher
1.	Artificial Intelligence for Autonomous Vehicles	Sandeep Kumar, B. Gurumoorthy	2024	John Wiley & Sons
2.	Autonomous Vehicles and Future Mobility" *By*	*Pierluigi Coppola, Domenico Esposito*	20112	Elsevier

FIRST SEMESTER

Course Code	Course Name	Th	Tu	Pr	Credits	Evaluation		
						CA	ESE	Total
26AT105T(iii)	PE– II Noise, Vibration and Harshness	4	-	-	4	40	60	100

Course Objectives	Course Outcomes
1.To inculcate measurement and analysis techniques for vehicle noise and vibration 2.To familiarize with the application of NVH refinement in vehicles and their systems 3.To introduce advanced techniques in reduction of NVH 4.Enable to use simulation tools to analyse the signals for reducing noise.	1. Analyse vibrations of SDOF, MDOF and Continuous systems, vibration measurement and analysis. 2. Acquire vibration and noise signals and evaluate them by applying various techniques including modal analysis. 3. Apply Principles of NVH refinement in Vehicles and their systems – power train, chassis, body, suspension, etc., 4. Evaluate acoustic materials and apply them for noise reduction. 5. Perform NVH simulation, Statistical Energy Analysis, Acoustic Holography, beam forming, etc.,

Unit I	**[12 Hrs**
NVH in the Automotive Industry: Sources of noise and vibration, design features, common problems, pass-by noise requirements, target vehicles and objective targets, vehicle structure noise, engine noise, transmission noise, exhaust noise**.**	
Unit II	**[12 Hrs**
Vibration Theory: Transient and steady-state response of one-degree-of-freedom systems applied to vehicle systems, transmissibility, modes of vibration.	
Unit III	**[12 Hrs**
Basics of Sound: Sound measurement, human sensitivity and weighting factors, combining sound sources, acoustical resonances, properties of acoustic materials.	
Unit IV	**[12 Hrs**
Signal Processing: Sampling, aliasing, and resolution, statistical analysis, frequency analysis, Campbell's plots, cascade diagrams, coherence, and correlation functions.	
Unit V	**[12 Hrs**
NVH Control Strategies & Comfort: Source ranking, noise path analysis, modal analysis, vibration absorbers and Helmholtz resonators, active noise control techniques .	

Text Books

S.N	Title	Authors	Edition	Publisher
1	Noise and Vibration Control	Munjal, M.L.	2013	USA World Scientific Publishing Co.Pvt.Ltd.,
2	Noise and vibration control engineering - principles and applications	Ver, Istvanl	2006	John Wiley & Sons,

Reference Books

S.N	Title	Authors	Edition	Publisher
1	Active control of noise and vibration	Hansen, Colin; Snyder, Scott	2013	New York CRC PRESS,
2	Fundamentals of noise and vibration analysis for engineers	Norton Michael, Norton Michael	2nd ed., 2003	USA Cambridge University Press

FIRST SEMESTER

Course Code	Course Name	Th	Tu	Pr	Credits	Evaluation		
						CA	ESE	Total
26AT106P	Technical Seminar & Research Paper Writing	-	-	2	1	50	-	50

Course Objectives	Course Outcomes
1.To develop technical communication and presentation skills 2..To understand the structure and ethics of academic writing. 3.To identify research areas and analyze current trends. 4.To write and present a research/technical paper effectively.	1. Select a relevant technical/research topic. 2. Conduct literature review using scholarly resources. 3. Draft a well-structured technical or research paper. 4. Apply proper citation and referencing techniques. 5. Deliver effective oral presentations using visual aids.

Module I	**[3 Hrs]**
Introduction to Technical Seminar: Purpose of seminars in academia and industry, Selection of seminar topics, Sources for current and emerging technologies, Guidelines for seminar report preparation.	
Module II	**[3 Hrs]**
Basics of Research Writing:Types of research papers: review, empirical, case study, conceptual, Components of a research paper (Abstract, Introduction, Literature Review, Methodology, Results, Discussion, Conclusion),Understanding the difference between technical and research writing.	
Module III	**[3 Hrs]**
Literature Review and Plagiarism:-Searching for literature (IEEE Xplore, Science Direct, Google Scholar, etc.),Summarizing and synthesizing research, Plagiarism: meaning, types, and how to avoid it,Use of plagiarism detection tools (Turnitin, Grammarly, etc.).	
Module IV	**[3 Hrs]**
Writing Tools and Referencing:- Citation styles (IEEE, APA, MLA, etc.),Reference managers: Mendeley, Zotero, EndNote, Formatting using MS Word / LaTeX.	
Module V	**[3 Hrs]**
Oral Presentation Skills:-Structure of a technical presentation, Designing effective PowerPoint slides, Public speaking tips, voice modulation, handling Q&A,Use of visuals and animations effectively **Seminar/Research Paper Presentation:-**Individual presentation of seminar topic, Submission of research/technical paper/report, Peer feedback and self-assessment.	

Text Books

S.N	Title	Authors	Edition	Publisher
1.	Technical Communication: Principles and Practice	Meenakshi Raman & Sangeeta Sharma	3rd Edition	Oxford University Press
2.	A Manual for Writers of Research Papers, Theses, and Dissertations	Kate L. Turabian	9th Edition	University of Chicago Press

Reference Books

S.N	Title	Authors	Edition	Publisher
1.	How to Write and Publish a Scientific Paper	Barbara Gastel & Robert A. Day	9th Edition	Cambridge University Press
2,	Technical Writing: Process and Product	Sharon J. Gerson, Steven M. Gerson	8th Edition	Pearson Education