FACULTY OF ENGINEERING & TECHNOLOGY

Effective from Academic Batch: 2022-23

Programme: **Bachelor of Technology (Automobile Engineering)**

Semester: **VII**

Course Code: **202010704**

Course Title: **Vehicle Testing and Homologation**

Course Group: **Professional Core Course**

Course Objectives: This subject will give preliminary idea regarding some of the practices and standards followed in automobile industry for their testing and homologation. Number of rules and norms applicable to automobiles has increased due to improved prominence on safety and environmental protection. Newly designed automobile models are to be tested thoroughly for its performance, quality and safety before it reaches to the occupants. Homologation is the activity of certifying vehicles, their systems and every individual component fitted in a vehicle. System has to satisfy the requirements set by various statutory / regulatory bodies and it is also mandatory to get approval from the homologation centers. This subject will give preliminary idea regarding some of the practices, testing and standards followed in automobile industry for testing and homologation.

Teaching & Examination Scheme:

Contact hours per week			Course Credits	Examination Marks (Maximum / Passing)				
				Internal		External		Total
Lecture	Tutorial	Practical		Theory	J/V/P*	Theory	J/V/P*	
3	0	2	4	50 / 18	25 /9	50 / 17	25 / 9	150 / 53

* **J**: Jury; **V**: Viva; **P**: Practical

Detailed Syllabus:

Sr.	Contents	Hours
1	**Introduction**: Need of vehicle testing and homologation, various homologation and testing centers, Hierarchy of testing: Individual component approval, System level approval and Whole vehicle approval. Conformity of Production tests.	4

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2	**Automobile testing standards (AIS):** Introduction, overview and study of testing standards; AIS testing standards, Euro Standards, BS standards, SAE standards. ISO26262 standards for functional safety of electrical and/or electronic systems in automobiles. Understanding of AIS Standards: AIS-008 (Installation requirements of lighting and light-signaling devices for motor vehicles having more than three wheels, trailer and semitrailer excluding agricultural tractor and special purpose vehicles), AIS-037 (Procedure for Type Approval and establishing conformity of production for safety of critical components), AIS003 (Automotive Vehicles - Starting Gradeability -Method of Measurement and Requirements), AIS-038 (Battery Operated Vehicles – Requirements for Construction and Functional Safety), AIS-011 (windscreen wiping system)	**5**
3	**Engine and Emissions Test**: Testing of basic engine parameters: Measurement of BHP, IHP, Engine testing on dynamometers, different types of dynamometers hydraulic, eddy current etc., Engine analyzers- For petrol and diesel engines, Emission test for CO, HC, NOx, CO_2, PM, etc. using exhaust gas analyzers, Spectroscopic methods, NDIR (Non Dispersive Infrared), FID (Flame Ionization Detector), Chemiluminescent analyzers, Gas Chromatograph, Smoke meters, orsat apparatus.	**6**
4	**Noise and vibration Test**: Basic Concepts of Vibration, vibration fundamentals, sources of vibration: engine, powertrain, suspension, wheels and tyres, body structure, seat mountings, body materials. Vibrations Testing: Vibration pick-up, Types of Transducers, Vibrometer, Types of dampers, vibrations absorber / isolators. Basic Concepts of Noise: Fundamentals of Acoustics. General Types of fundamentals of acoustics, human response to sound, sources of noise, noise measurement: Brake Squeal noise, Pass-by Noise, wind noise, squeak noise and rattle, interior noise, noise from engine accessories, Noise due to Tyre-Road friction. Noise Testing: Microphone, Sound intensity probes, Study of anechoic chamber. NVH –Legislations applicable for vehicles in India	**7**
5	**Vehicle system performance test:** Methods for evaluating vehicle performance- energy consumption in conventional automobiles, world motorcycle test cycle (WMTC), Operation of full load and part load conditions, tyre, road condition and driving habits on fuel economy, Gradability test, Turning circle diameter test, Steering Impact test, Steering effort test.	**6**
6	**Vehicle testing on chassis dynamometers:** Two wheel & four wheel dynamometers, vehicle testing lanes - side slip testers, wheel alignment testing, wheel balancing, brake test, head light alignment and light intensity testing.	**4**
7	**Testing on Tracks**: Various test track and applications, Engine running and durability, intensive driving, maximum speed and acceleration, brake testing on road, hill climbing, handling and ride characteristics, safety, road testing, test tracks, brake testing, maneuverability test, High Speed Track, Wet skid pad, Test slopes, External noise test track, Accelerated fatigue track, Water wade, Salt water wade, Gravel road and off road track, Dry handling circuit, Comfort track, torture tracks.	**6**

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8	**Active and Passive Safety test:** NCAP test standards, Wheel rim testing for cornering and radial fatigue, Fire resistance test, bumper test, crash test, side impact test, rollover test, safety belt test, Airbag test, Safety belt anchorages, Seat anchorages & head restraints, Occupant protection Impact test, Side door intrusion test.	**5**
9	**Electric Vehicle Test:** Introduction, testing and approval, AIS for EV testing, thermal test, construction and functional safety test, Battery management test.	**2**

List of Practicals / Tutorials:Click or tap here to enter text.

1	To demonstrate the performance characteristics of automobile petrol engine.
2	To demonstrate the performance characteristics of automobile diesel engine.
3	To demonstrate performance characteristic of electric vehicle.
4	To demonstrate pollution control process for petrol, diesel and CNG on PUC equipment.
5	To demonstrate brake stopping distance.
6	To demonstrate turning circle diameter test.
7	To demonstrate Air bag parts and its function.
8	To demonstrate engine exhaust noise test for various automobiles.
9	To demonstrate vibration and noise test of automotive body.
10	To demonstrate maneuverability test.
11	To demonstrate horn intensity test.

Reference Books:

1	Raymond M. Brach and R. Matthew Brach, "Vehicle Accident Analysis and Reconstruction Methods", SAE International, 2011
2	J. G. Giles – Vehicle operation and performance, Wildlife Publications, London, 1969.
3	W. H. Crouse and L. Anglin – Motor vehicle inspection, McGraw Hill Book Co. 1978.
4	Ulrich Seiffert and Lothar Wech, “Automotive Safety Handbook”, SAE International, 2007.
5	AIS Standards.
6	NCAP test Standards.
7	ARAI, Icat and NATRIP vehicle standards.

Supplementary learning Material:	
1	NPTEL resources.

Pedagogy:

- Direct classroom teaching
- Audio Visual presentations/demonstrations

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- Assignments/Quiz
- Continuous assessment

Internal Evaluation :
The internal evaluation comprised of written exam (40% weightage) along with combination of various components such as Certification courses, Assignments, Mini Project, Simulation, Model making, Case study, Group activity, Seminar, Poster Presentation, Unit test, Quiz, Class Participation, Attendance, Achievements etc. where individual component weightage should not exceed 20%.

Suggested Specification table with Marks (Theory) (Revised Bloom's Taxonomy):

Distribution of Theory Marks						**R**: Remembering; **U**: Understanding; **A**: Application, **N**: Analyze; **E**: Evaluate; **C**: Create
R	**U**	**A**	**N**	**E**	**C**	
25	25	25	15	5	5	

Note: This specification table shall be treated as a general guideline for students and teachers. The actual distribution of marks in the question paper may vary slightly from above table.

Course Outcomes (CO):

Sr.	Course Outcome Statements	%weightage
CO-1	Understand the need of vehicle standards, testing and homologation.	**20**
CO-2	Understand the vehicle emission, vehicle performance with reference to automotive standards.	**30**
CO-3	Understand the procedures of evaluating the vehicle noise and vibration.	**15**
CO-4	Understand the importance of automotive testing on dynamometer and test tracks.	**20**
CO-5	Understand the importance of automotive ICE & EV safety and testing.	**15**

Curriculum Revision:	
Version:	2
Drafted on (Month-Year):	June-2022
Last Reviewed on (Month-Year):	
Next Review on (Month-Year):	June-2027

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