GUJARAT TECHNOLOGICAL UNIVERSITY

BRANCH NAME: AUTOMOBILE ENGINEERING (02)

SUBJECT NAME: VEHICLE TESTING AND HOMOLOGATION
SUBJECT CODE: 2170204

B.E. 7th SEMESTER

Type of course: Under Graduate

Prerequisite: Automobile Engineering fundamentals

Course objective:
The number of rules and norms applying to automobiles has increased globally due to increased emphasis on safety and environmental protection. Newly designed automobiles or automobile models are to be tested thoroughly for its performance and safety before it reaches to the users. Automotive homologation is the activity of certifying vehicles and every component fitted in a vehicle has to satisfy the requirements set by various statutory / regulatory bodies. It is mandatory to get approval for export of automobile products or its components. This subject will give preliminary idea regarding some of the practices and standards followed in automobile industry for their testing and homologation.

Teaching and Examination Scheme

Teaching Scheme (Hours)			Total Credits	Theory Marks		Tutorial / Practical Marks		Total Marks
Theory	Tutorial	Practical		ESE(E)	PA (M)	Viva (V)	PA(I)	
4	0	2	6	70	30	30	20	150

Course Content

Sr. No	Content	Total Hrs.	% Weightage
1.	**Introduction:** Need of vehicle testing and homologation, Vehicle testing organizations, Hierarchy of testing: Individual component approval, System level approval and Whole vehicle approval. Type Approval & Conformity of Production tests.	**02**	**03**
2.	**Engine ,Fuel systems and Emissions Testing:** Laboratory 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, FIP calibrating and testing, Emission test for CO, HC, NOx, CO_2, PM, etc. using exhaust gas analyzers, their types. Orsat apparatus, infrared gas analyzers, smoke meter.	**07**	**14**

3.	**Noise vibration and Harshness Testing:** Review of vibration fundamentals, vibration control, fundamentals of acoustics, human response to sound, automotive noise criteria, Standard noise measurement methods, Noise inside and outside the vehicle, sources of vehicle noise- intake and exhaust noise, combustion noise, mechanical noise, noise from auxiliaries, wind noises, transmission noises, brake squeal, structure noise, noise control methods. Pass by Noise testing method.	**07**	**14**
4.	**Vehicle Performance Testing:** Methods for evaluating vehicle performance- energy consumption in conventional automobiles, performance, emission and fuel economy, Operation of full load and part load conditions, effect of vehicle condition, tyre and road condition and traffic condition and driving habits on fuel economy, Gradability test, Turning circle diameter test, Steering Impact test, Steering effort test.	**06**	**15**
5.	**Road and track testing:** Initial inspection, PDI, engine running in and durability, intensive driving, maximum speed and acceleration, brake testing on the road, hill climbing, handling and ride characteristics, safety, mechanism of corrosion, three chamber corrosion testing, wind tunnel testing, road testing, test tracks.	**06**	**14**
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.	**06**	**15**
7.	**Active and Passive Safety testing:** 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.	**06**	**15**
8.	**Automobile testing standards:** Introduction, overview and study of testing standards like; AIS testing standards, Euro Standards, SAE standards. ISO26262 standards for functional safety of electrical and/or electronic systems in automobiles. ***Understanding of some AIS Standards:*** AIS-008 (Installation requirements of lighting and light-signaling devices for motor vehicles having more than three wheels, trailer and semi-Trailer excluding agricultural tractor and special purpose vehicles), AIS-018:2001 (Automotive Vehicles - Speed limitation Devices – Specifications), AIS-037 (Procedure for Type Approval and establishing conformity of production for safety of critical components), AIS-093 (Code of practice for construction and approval of truck cabs & truck bodies), AIS-003 (Automotive Vehicles - Starting Gradeability - Method of Measurement and Requirements), AIS-038 (Battery Operated Vehicles – Requirements for Construction and Functional Safety).	**06**	**10**

Suggested Specification table with Marks (Theory): Distribution of Theory Marks

R Level	U Level	A Level	N Level	E Level	C Level
10	**15**	**15**	**10**	**10**	**10**

Legends: R: Remembrance; U: Understanding; A: Application, N: Analyze and E: Evaluate C: Create and above Levels (Revised Bloom's Taxonomy)

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.

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. Dr. N.K.Giri- Automotive technology – Khanna publishers, 2009
5. Ulrich Seiffert and Lothar Wech, "Automotive Safety Handbook", SAE International, 2007
6. ISO Standards, ICS: 43.020, 43.040, 43.100

List of suggested Practicals:

1. To study the performance characteristics of automobile petrol engine
2. To study the performance characteristics of automobile diesel engine
3. To study the performance characteristics of automobile engine operated on alternate fuel (CNG, LPG, Bio Diesel).
4. To study the performance characteristics of Electric.
5. To study the performance characteristics of Hybrid Electric vehicles.
6. Calibration of fuel injection pump and testing.
7. Calibration of Diesel Injectors.
8. Calibration of Petrol Injectors.
9. Head light beam alignment and testing.
10. Vehicle horn intensity testing.
11. Measurement of Brake stopping distance.
12. Vehicle testing on chassis dynamometers.
13. Analyze the emissions of petrol, diesel and CNG vehicles using exhaust gas analyzer.
14. Gradability test.
15. Turning circle diameter test.
16. Measurement of steering effort.
17. Pass by noise test.
18. Study of Bus Body code.