Semester:	7				
Course Code:	ME5090				
Course Name:	Automobile Engineering				
Credits Value:	3 (Notional hours: 150)				
Pre-requisites:	None				
Core/ Optional:	Optional				
Hourly Breakdown	Lectures (hours)	Tutorials (hours)	Practical classes (hours)	Assignments (hours)	Independent Learning & Assessment (hours)
	37			16	97

Course Aim: To provide an in-depth understanding of working principles of different powertrain systems, modeling and simulation of driveline dynamics and vehicular dynamics of automobiles operating in different driving conditions.

Intended Learning Outcomes:

On successful completion of the course, the students should be able to;

- **analyze** the operating characteristics of Internal Combustion (IC) engines and electric/hybrid powertrain systems of automobiles.
- **relate** the engine operating conditions to exhaust gas emission and describe the emission control techniques and environmental impact of IC engines.
- **model** and **analyze** longitudinal dynamics of automobiles
- **model** and **analyze** the stability and control of automobiles
- **model** the **analyze** the driveline systems of automobiles.

Course Content:

- **Introduction**: Vehicle classification, structure, and layouts; powertrain Systems; powertrain Components; vehicle performance
- **Internal Combustion Engines:** Principle of operation of spark ignition and compression ignition engines; engine performance characteristics, turbo-charging and Supercharging;; engine torque generation; torque maps; engine modeling, engine cooling systems; engine lubrication; engine management system; engine performance testing; emission formation and emission reduction technologies; fuels and fuel consumption: engine energy consumption, driving cycles, shifting effects.
- **Electric Vehicles:** Configurations of electric vehicle; basic systems of battery electric vehicles; performance of electric vehicles: traction motor characteristics, tractive effort and transmissions requirements, vehicle performance, energy consumption; battery technology and management;

introduction to fuel cell vehicles

- **Hybrid Vehicles:** Types of hybrid electric vehicles; Power split devices; HEV component characteristics; Hybrid Electric Vehicle (HEV) performance analysis; HEV modeling and simulation of HEV.
- **Vehicle Longitudinal Dynamics:** Introduction vehicle driveline; fundamentals of driveline; different types of driveline arrangements; differential; tractive force; resistive forces; vehicle constant power performance; constant torque performance; fixed throttle performance; throttle pedal cycle performance; tyre slip; performance on a slope; vehicle coast down; driveline losses.
- **Transmissions:** Manual transmission; automatic transmission; continuously varying transmission (CVT).
- **Driveline Dynamics:** Modeling driveline dynamics; bond graph models of driveline components; driveline models.
- **Vehicle Stability and Control:** Suspension system; braking systems; front axle and steering systems; wheels and tyres; lateral loading and Vehicle stability Control.

Teaching/ Learning Methods:
Classroom lectures, tutorials and in-class exercises and assignments

Assessment Strategy:

Continuous Assessment 40%		**Final Assessment** 60%		
Details:		Theory (%)	Practical (%)	Other (%) (Project)
Assignments/Quizzes	20%	60%		
Mid Semester Examination	20%			

Recommended Reading:

- G. K. Awari, V. S. Kumbhar, and R. B. Tirpude (2021), *Automotive Systems-Principles and Practice*, CRC Press, New York,.
- Behrooz Mashadi, David Crolla (2012), *Vehicle Powertrain Systems*, John Wiley & Son Ltd,West Sussex, United Kingdom.
- David A. Crolla, *Automotive Engineering-Powertrain, Chassis System and Vehicle Body*, Elsevier Inc., 200, Oxford, United Kingdom.
- John B. Heywood (2018), *Internal Combustion Engine Fundamentals* (2nd Edition), McGraw-Hill Education, New York, USA.