Tulsiramji Gaikwad-Patil College of Engineering and Technology
Wardha Road, Nagpur-441108
NAAC Accredited with A+ Grade
(An Autonomous Institute Affiliated to RTM Nagpur University, Nagpur)

Third Year (Semester-V) B.Tech. Mechanical Engineering

BME33525: Lean Manufacturing & Six Sigma (Honor Course)

Teaching Scheme		Examination Scheme	
Lectures	3 Hr / Week	**CT**	30
Tutorials	-	**CA**	10
Total Credits	3	**ESE**	60
		Total	100 Marks
		Duration of ESE: 03 Hrs	

Course Objectives:

1	To introduce the fundamentals, principles, and philosophy of Lean Manufacturing and Six Sigma.
2	To understand various Lean tools and techniques used for waste elimination and process improvement.
3	To study Six Sigma methodology (DMAIC) and statistical quality control tools.
4	To develop problem-solving skills using Lean and Six Sigma tools in manufacturing and service industries.
5	To understand implementation strategies, challenges, and integration of Lean and Six Sigma in industries.

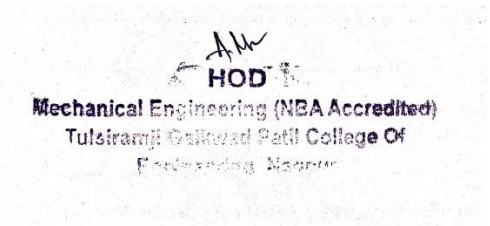
Course Contents

Unit I	**Introduction to Lean Manufacturing** Evolution of Lean Manufacturing,Toyota Production System (TPS) **,**Principles of Lean Thinking, Types of Waste (Muda, Mura, Muri),Value, Value Stream, Flow, Pull and Perfection **,** Lean vs Traditional Manufacturing
Unit II	**Lean Tools and Techniques** 5S Methodology **,**Kaizen (Continuous Improvement),Value Stream Mapping (VSM),Just-In-Time (JIT),Kanban System **,**Poka-Yoke (Error Proofing) **,**SMED (Single Minute Exchange of Dies) **,**Total Productive Maintenance (TPM),Cellular Manufacturing
Unit III	**Introduction to Six Sigma** History and evolution of Six Sigma ,Concepts of variation and defects, Sigma levels and process capability, Roles in Six Sigma (Green Belt, Black Belt, etc.),DMAIC methodology overview, Lean vs Six Sigma.
Unit IV	**Six Sigma Tools and Statistical Techniques** Define Phase: Project selection, Voice of Customer (VOC), SIPOC, Measure Phase: Data collection, Basic statistics, Control charts, Analyze Phase: Cause and effect diagram, Pareto chart, Hypothesis testing, Improve Phase: Brainstorming, Design of Experiments (DOE) (basic),Control Phase: Control plans, SPC, Documentation
Unit V	**Implementation of Lean Six Sigma** Lean Six Sigma integration ,Case studies in manufacturing and service sector, Benefits and challenges of implementation ,Cultural change and leadership role ,Industry 4.0 and Lean integration, Sustainability and continuous improvement

Text Books	
T.1	Lean Six Sigma: Combining Six Sigma Quality with Lean Production Speed by Michael L. George
T.2	Lean Thinking: Banish Waste and Create Wealth in Your Corporation by James P. Womack & Daniel T. Jones
T.3	Lean Manufacturing: Tools, Techniques, and How to Use Them by William M. Feld
Reference Books	
R.1	The Lean Six Sigma Pocket Toolbook by Michael L. George, David T. Rowlands, Mark Price & John Maxey
R.2	Six Sigma: The Breakthrough Management Strategy Revolutionizing the World's Top Corporations by Mikel Harry & Richard Schroeder
R.3	Implementing Lean Six Sigma: A Practical Guide to Tools and Techniques" by Forrest W. Breyfogle III

Useful Links	
1	https://onlinecourses.nptel.ac.in/noc23_mg17/preview
2	https://onlinecourses.nptel.ac.in/noc21_mg13/preview

Course Code	Course Outcomes	CL	Class Sessions
BME33525.1	Explain the principles and philosophy of Lean Manufacturing and Six Sigma.	**2**	**9**
BME33525.2	Apply Lean tools such as 5S, VSM, JIT, Kanban, and TPM to identify and eliminate waste.	**3**	**9**
BME33525.3	Analyze process variation and defects using Six Sigma DMAIC methodology and statistical tools.	**4**	**9**
BME33525.4	Evaluate process performance using control charts and process capability indices.	**5**	**9**
BME33525.5	Develop improvement strategies by integrating Lean and Six Sigma concepts for real-world problems.	**5**	**9**



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Third Year (Semester-V) B.Tech. Mechanical Engineering

BME33521: Four Wheeler Technology(Minor Course)

Teaching Scheme		Examination Scheme	
Lectures	3 Hr / Week	**CT**	30
Tutorials	-	**CA**	10
Total Credits	3	**ESE**	60
		Total	100 Marks
		Duration of ESE: 03 Hrs	

Course Objectives:

1	To provide knowledge of construction, working principles, and systems used in four-wheelers.
2	To understand engine systems, transmission systems, and vehicle layout.
3	To study steering, suspension, braking, and tyre systems of four-wheelers.
4	To understand vehicle electrical, electronic systems, and safety features.
5	To develop the ability to analyze vehicle performance and diagnose basic automotive problems.

Course Contents

Unit I	**Introduction to Four Wheeler** Classification of four-wheelers (Passenger, Commercial, SUV, etc.) ,Vehicle layout: Front engine rear wheel drive (FR), Front wheel drive (FF), Rear engine rear drive (RR), 4WD ,Major components of a four-wheeler ,Chassis and frame construction ,Automobile industry trends
Unit II	**Engine and Fuel System** IC Engines used in four-wheelers (Petrol & Diesel) **,**Engine components and working, MPFI and CRDI systems **,**Air intake and exhaust system, Cooling and lubrication systems
Unit III	**Transmission System** Clutch: Types and working **,**Gearbox: Sliding mesh, Constant mesh, Synchromesh **,**Automatic transmission (basic introduction),Propeller shaft and universal joints, Differential and rear axle, Drive shaft and final drive
Unit IV	**Steering, Suspension and Braking System** Steering system: Mechanical & Power steering **,**Wheel alignment and wheel balancing **,**Suspension system: Independent & Rigid axle, Shock absorbers, Braking system: Drum brake, Disc brake, Hydraulic and ABS braking system, Tyres and wheels
Unit V	**Electrical, Safety and Modern Technologies** Automotive electrical system: Battery, Alternator, Starter, Lighting and signalling system, Electronic Control Unit (ECU) basics **,**Sensors and actuators, Airbags and safety systems **,**Introduction to Hybrid and Electric Four-wheelers, Basic vehicle diagnostics

Text Books	
T.1	Automobile Engineering by Kirpal Singh
T.2	Automotive Mechanics by William H. Crouse & Donald L. Anglin
T.3	Automotive Engineering Fundamentals by Richard Stone and Jeffrey K. Ball
Reference Books	
R.1	Automotive Technology: Principles, Diagnosis, and Service by James D. Halderman
R.2	Automobile Engineering: A Systems Approach by Jack Erjavec & Rob Thompson
R.3	Internal Combustion Engines (Theory and Practice) by V. Ganesan

Useful Links	
1	https://onlinecourses.nptel.ac.in/noc24_de03/preview
2	https://www.digimat.in/nptel/courses/video/107106088/107106088.html

Course Code	Course Outcomes	CL	Class Sessions
BME33521.1	Explain the construction and working principles of major systems used in four-wheelers.	**2**	**9**
BME33521.2	Describe engine systems, fuel injection systems, and transmission mechanisms.	**2**	**9**
BME33521.3	Analyze steering, suspension, and braking systems for vehicle performance and safety.	**4**	**9**
BME33521.4	Illustrate automotive electrical and electronic systems used in modern vehicles.	**3**	**9**
BME33521.5	Diagnose basic operational problems and evaluate vehicle performance parameters.	**5**	**9**