M.E Semester: 2 M.E Mechanical (Automobile Engineering)
Subject Name: Automotive Materials and Manufacturing (Elective- II) MEA206A

A. **Course Objective**

- To present a problem oriented in depth knowledge of Automobile materials and manufacturing
- To address the underlying concepts and methods behind Automobile materials and manufacturing

B. **Teaching / Examination Scheme**

SUBJECT		Teaching Scheme				Total Credit	Evaluation Scheme					Total Marks
		L	T	P	Total		THEORY		IE	CIA	PR. / VIVO	
CODE	NAME	Hrs	Hrs	Hrs	Hrs		Hrs	Marks	Marks	Marks	Marks	
MEA206A	Automotive materials and manufacturing	3	0	0	3	3	3	70	30	20	0	120

C. **Detailed Syllabus**

1. Advanced Materials: Composites – non metallic and metallic. Other specialty materials used in Automotive design and manufacturing. Role of Nano technology in automotive systems.
2. Mechanics of Polymers: Constitutive equation for linear small strain viscoelastic response; constant rate and sinusoidal responses; time and frequency dependent material properties; energy dissipation; structural applications including axial loading, bending, torsion; three dimensional response, thermo-viscoelasticity, correspondence principle, Laplace transform and numerical solution methods.
3. Composite Materials: Mechanics, Manufacturing and Design. Composite materials, including naturally occurring substances such as wood and bone, and engineered materials from concrete to carbon-fiber reinforced epoxies. Development of micromechanical models for a variety of constitutive laws. Link between processing and as-manufactured properties through coupled fluid and structural analyses.
4. Smart Materials and Structures: Theoretical aspects of smart materials, sensors and actuator technologies. It will also cover design, modeling and manufacturing issues

involved in integrating smart materials and components with control capabilities to engineering smart structures.

5. Materials in Manufacturing and Design: Material selection on the basis of cost, strength, formability and machinability. Advanced strength analysis of heat-treated and cold-formed parts including axial, bending, shear and cyclic deformation. Correlations of functional specifications and process capabilities. Problems in redesign for productibility and reliability.
6. Time Series Modeling: Analysis, Forecasting. Time series modeling, analysis, forecasting, and control, identifying parametric time series, autovariance, spectra, Green's function, trend and seasonality. Examples from manufacturing, quality control, ergonomics, inventory, and management.
7. Laser Materials Processing: Application of lasers in materials processing and manufacturing. Laser principles and optics. Fundamental concepts of laser/material interaction. Laser welding, cutting, surface modification, forming, and rapid prototyping. Modeling of processes, microstructure and mechanical properties of processed materials. Transport phenomena. Process monitoring.
8. Assembly Modeling for Design and Manufacturing: Assembly on product and process. Assembly representation. Assembly sequence. Datum flow chain. Geometric Dimensioning and Tolerancing. Tolerance analysis. Tolerance synthesis. Robust design. Fixturing. Joint design and joining methods. Stream of variation. Auto body assembly case studies.

D. **Lesson Planning**

SR.NO	DATE/WEEK	UNIT NO	%WEITAGE	TOPIC NO
1	1^{ST} , 2^{ND} , 3^{RD}	1	20	1,2
2	4^{TH} ,5^{TH} , 6^{TH}	2	20	3,4
3	7^{TH} ,8^{TH} , 9^{TH}	3	20	5
4	10^{TH} ,11^{TH} , 12^{TH}	4	20	6,7
5	13^{TH} ,14^{TH} , 15^{TH}	5	20	8

E. **Instructional Method & Pedagogy**

- At the start of course, the course delivery pattern , prerequisite of the subject will be discussed
- Lecture may be conducted with the aid of multi-media projector, black board, OHP etc. & equal weightage should be given to all topics while teaching and conduction of all examinations.

- Attendance is compulsory in lectures and laboratory, which may carries five marks in overall evaluation.
- One/Two internal exams may be conducted and total/average/best of the same may be converted to equivalent of 30 marks as a part of internal theory evaluation.
- Assignment based on course content will be given to the student for each unit/topic and will be evaluated at regular interval. It may carry an importance of ten marks in the overall internal evaluation.
- Surprise tests/Quizzes/Seminar/Tutorial may be conducted and having share of five marks in the overall internal evaluation.

F. **Students Learning Outcomes**

- The student can identify different areas of automobile materials and manufacturing.
- Can find the applications of all the areas in day to day life.

G. **Recommended Study Materials**

- **Text & Reference Books:**

1. Michael F. Ashby, “Materials Selection in Mechanical Design”, Butterworth Heinemann, 2005.
2. Daniel Yesudian C., “Materials Science and Metallurgy”, Scitech Publications (India), 2004.
3. Polmear I.J., “Light Alloys”, Arnold Publishers, 1995.
4. Swarup D. and Saxena M.N., "Elements of Metallurgy", Rastogi Publishers, Meerut, 1994.
5. Srinivasan N.K. and Ramakrishnan S.S., "The Science of Engineering Materials", Oxford and IBH Pub. Co., New Delhi , 1993.
6. Van Vlack L.H., "Elements of Materials Science and Engineering", Addison Wesley, New York, 1991.
7. Guy A.G," Elements of Physical Metallurgy", Oxford & IBH Pub. Co., 1990.