- Leo D.J., (2007) Engineering Analysis of Smart Material Systems, Wiley.
- Addington M., Schodek D.L., (2005) Smart Materials and New Technologies in Architecture, Elsevier.
- Otsuka K., Wayman (Eds.) C.M., (1998) Shape Memory Materials, Cambridge University Press.
- Gandhi, M.V., Thompson B. S., (1992) Smart Materials and Structures, Chapman & Hall.
- Schwartz, M., (2006) New Materials, Processes, and Methods Technology, CRC Press.

SUGGESTIVE READINGS

- Ball, P., (1997) Made to Measure: Materials for the 21st Century, Princeton University Press.
- Galaev, I., Mattiasson, B., (Eds.), (2008) Smart Polymers: Applications in Biotechnology and Biomedicine, 2nd ed, CRC Press.
- Yui, N., Mrsny, R. J., Park, hK., (Eds.), (2004) Reflexive Polymers and Hydrogels: Understanding and Designing Fast Responsive Polymeric Systems, CRC Press.

Note: Examination scheme and mode shall be as prescribed by the Examination Branch, University of Delhi, from time to time.

DISCIPLINE SPECIFIC ELECTIVE COURSES (DSE-12)

CREDIT DISTRIBUTION, ELIGIBILITY AND PRE-REQUISITES OF THE COURSE

Course title & Code	Credits	Credit distribution of the course			Eligibility criteria	Pre-requisite of the course
		Lecture	Tutorial	Practical/ Practice		
AUTOMOBILE APPLICATIONS OF POLYMERS	**4**	**3**	**0**	**1**	**Class 12th with Physics, Chemistry**	**---**

Learning objectives

- To know various sources of materials used in automobiles.

- To learn about polymeric materials significance in automobiles structural and mechanical components.
- To study about rubber components used in automobiles.

Learning outcomes

After completing this course, the students

- Explain the knowledge about requirements of automobile industry.
- Apply the polymeric (plastic) components in automobile interior and exterior parts.
- Determine the rubber components used in automobile parts.

SYLLABUS OF DSE-12

THEORY COMPONENT-

UNIT 1: (8 Hours)

INTRODUCTION TO AUTOMOTIVE COMPONENTS AND MATERIALS

History of automobile industry, need for polymers, advantages and limitations of polymers, competition between plastics, composites and other materials, processing, designing with plastics, selection criteria of material.

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UNIT 2: (10 Hours)

POLYMERS IN THE INTERIOR OF THE VEHICLE

Interiors, dominance of polymeric components, Fashion and function, Plastics surfaces (Texture and fogging), Plastic structure and panel application (Sandwich concept, Instrumental panel, other sensitive panels), Structural and mechanical components (Seating, Door and window furniture, steering wheel, airbags, seat belts, pedals, instrumental and others).

UNIT 3: (10 Hours)

POLYMERS IN THE EXTERIOR OF THE VEHICLE

Exteriors: Body panels and structure – Painting problems – Bumpers – Other exteriors: Grills, Spoilers, Mirrors, Door handles, Wheel trim, Road wheels, Sun roof components, Windscreen wiper assemblies.

UNIT 4: (10 Hours)

ENGINE, POWERTRAIN AND CHASSIS

The engine compartment, cooling system, under bonnet structure, transmission, engine hang on parts, engine interior, composite engine, suspension, steering, brakes, fuel tanks, electrics: battery boxes, circuitry, lighting and instrumentation, electronics.

UNIT 5: (7 Hours)

RUBBER PRODUCTS

Rubber mounts, spring, seals, O-ring, rubber to metal bonding components, coupling hoses, brake lining, disc brakes.

PRACTICAL COMPONENT (30 Hours)

- To prepare EPDM profile for windshield and door seal.
- To prepare bumper material and test its impact strength.
- To prepare O'Rings/gaskets material for sealing applications
- To manufacture automobile carpet/leather and test its mechanical and physical properties.
- To prepare laminated material for radiator pipe
- To manufacture carbon fibre-epoxy composite for high strength applications
- To prepare plastic joint and test its strength.
- To find out scratch resistance of a coated automobile part.
- To prepare composite for railway breaker
- To analyze flexural strength of jumping rod.
- Industrial Visit

ESSENTIAL/RECOMMENDED READINGS

- Maxwell, J,. (1994) “Plastics in the Automotive Industry”, SAE internationals, Woodhead Publication, England.
- Mann, D., (1999) “Automotive Plastics and Composites Worldwide Markets and Trends” to 2007, 2nd Edition , Elsevier advanced technology.
- Ashby, M. F., Shercliff, H., Cubon, D., (2007) “Materials Engineering Science, Processing and Design”, Butterworth Publications.
- Brian, C., Patrick, G., and Colin J., (2007) Automotive Engineering: Light Weight, Functional and Novel Materials, Taylor & Francis.

- Groover, M. P., (2005) Fundamentals of Modern Manufacturing: Materials, Processes, and Systems, 2nd edition, John Wiley & Sons.
- Stauber, R., Vollrath, L. (2007) Plastics in Automotive Engineering: Exterior Applications, Hanser publications.
- Marur, S., (2011) Plastics Application Technology for Safe and Lightweight Automobiles.

SUGGESTIVE READINGS

- Callister, W. D., (2005) Materials Science and Engineering an Introduction, 6th edition, John Wiley & Sons.
- Yamagata, H., (2005) The Science and Technology of Materials in Automotive Engines, Yamaha Motor Co. Ltd., Japan Woodhead Publishing Limited.
- Davies, G., (2003) Materials for Automobile Bodies, Butterworth-Heinemann Publications.
- Koronis, G. Silva, A., (2018) Green Composites for Automotive Applications, Woodhead Publishing Series in Composites Science and Engineering.
- Sehanobish, K., (2009)"Engineering Plastics and Plastic composites in Automotive Applications", SAE internationals, Warrendale.

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DISCIPLINE SPECIFIC ELECTIVE COURSES (DSE-13)

CREDIT DISTRIBUTION, ELIGIBILITY AND PRE-REQUISITES OF THE COURSE

Course title & Code	Credits	Credit distribution of the course			Eligibility criteria	Pre-requisite of the course
		Lecture	Tutorial	Practical/ Practice		
POLYMERS IN ENERGY APPLICATION	4	2	0	2	Class 12th with Physics, Chemistry	---

Learning objectives

The Learning Objectives of this course are to:

- Make students familiar with use of advanced polymers for energy applications
- Learn about the manufacturing of fuel cells