UNIVERSITI TEKNOLOGI MARA

PST675: SUSTAINABLE POLYMER TECHNOLOGY

Course Name (English)	SUSTAINABLE POLYMER TECHNOLOGY APPROVED
Course Code	PST675
MQF Credit	3
Course Description	The word sustainable implies clean and friendly environment. This course is concerned with waste management. Here waste management refers to means and ways of disposing wastes or scraps. Wastes or scraps can come from various materials and products such as metals, ceramics, papers, glasses, woods etc. However, this course is concerned with waste materials or products which are based from rubber and plastics (polymeric materials) only. The course will look into the current practice of disposing scrap tyres, rubbers and plastics, and will cover topics such as land filling, reclaiming process, recycling, energy recovery and pyrolysis. Other polymeric materials and technology which contribute to the green environment such as biodegradable plastics and sustainable technology will also be discussed.
Transferable Skills	Sustainable technology on waste management and Waste to Energy Processes which focusses on uitilisation of green polymers of biodegradable plastics and tires
Teaching Methodologies	Demonstrations, Field Trip, Case Study, Journal/Article Critique, Industrial Talk
CLO	CLO1 Define and elaborate on concepts of green chemistry and sustainability of the environment CLO2 Evaluate the problems of polymeric wastes such as thermoplastics, thermosets and rubber. CLO3 Organize ways of optimizing the use of thermoplastics and biodegradable polymers to minimize resource use, waste generation and post-consumer waste recovery problem. CLO4 Appraising various methods of managing waste: recycling and reuse, reclaiming, land filling, energy recovery, polymerization and curing techniques; merits and limitation of each method in terms of technology, efficiency and costs.
Pre-Requisite Courses	No course recommendations

Topics
1. 1.0 Introduction to sustainable development 1.1) The environment and sustainable development: an integrated waste management strategy for thermoplastics 1.2) Thermoplastics and biodegradable polymers An issue for sustainability and green environment 1.3) Integrated resource and waste management policies for thermoplastics 1.4) Issues and strategy on the utilisation of biodegradable polymers as environmentally safe materials
2. 2.0 Recycling Biopolymers 2.1) Composting and Material recycling 2.2) Application and Environmental Aspects of Chitin and Chitosan 2.3) Use of biosynthetic, biodegradable and thermoplastics from renewable resources: the pros and cons 2.4) Matter cycling in ecosystems
3. 3.0 Waste streams and management of thermoplastic and biodegradable polymers 3.1) 1. Thermoplastic and biodegradable production and global 3.2) consumption of the polymers 3.3) 2. Waste stream categories 3.4) 3. Recovery and recycling of thermoplastic and Biodegradable 3.5) waste in different countries 3.6) 4. Laws and limitation in thermoplastic waste management

4. 4.0 Future directions: towards sustainable technology from thermoplastics and Biodegradable polymers 4.1) 1. Introduction 4.2) 2. Designing for recyclability 4.3) 3. New polymer recycling technologies
5. 5.0 Introduction to waste management 5.1) 1. Statistics of rubber wastes 5.2) 2. Potential problems to environment - Air and water pollution, 5.3) Breeding of mosquitoes, rats, rodent and snakes 5.4) 3. Methods of managing rubber wastes 5.5) 4. Lean Management in Green Technology
6. 6.0 Land filling 6.1) 1. Introduction 6.2) 2. Methods of filling 6.3) 3. Merits and limitations
7. 7.0 Whole tyre recycling 7.1) 1. Introduction 7.2) 2. Technology of tire recycling 7.3) 3. Applications of tire recycling 7.4) 4. Merits and limitation of the process
8. 8.0 Reclaim rubber 8.1) 1. Introduction 8.2) 2. Methods of reclaiming 8.3) 3. Merits and limitations of each process 8.4) 4. Application of reclaimed rubber
9. 9.0 Energy recovery 9.1) 1 Introduction 9.2) 2 Methods of energy recovery 9.3) 3 Merits and limitations of each method
10. 10.0 Pyrolysis 10.1) 1. Introduction 10.2) 2. Method of pyrolysis 10.3) 3. Merits and limitations of pyrolysis
11. 11.0 Introduction to Green Chemistry and Sustainability 11.1) 1. Definition of Green Chemistry and sustainability 11.2) 2. The Concept of Atom Economy 11.3) 3. Risk and Hazard 11.4) 4. Clean Technology Pool 11.5) 5. Design for Degradation 11.6) 6. Life cycle Assessments and Lean Processing 11.7) 7 . Green Technology Legislation
12. 12.0 Renewable polymers 12.1) 1 Introduction to plant polymer : Resources, Demands and 12.2) Sustainability 12.3) 2 Polymer, Composites and Foam from Plant Oil 12.4) 3 Sugars 12.5) 4 Starch 12.6) 5 Cellulose/Hemicelluloses 12.7) 6 Poly(lactic Acid) 12.8) 7 Polyhyroxyalkonates 12.9) 8 Proteins 12.10) 9 Chitin and Chitosan

Assessment Breakdown	%
Continuous Assessment	50.00%
Final Assessment	50.00%

Details of Continuous Assessment

Assessment Type	Assessment Description	% of Total Mark	CLO
Assignment	2000 words essay based on Given Topic from the sylabus	20%	CLO1
Case Study	Case studies on waste management and green awareness at given site or scheduled work place and activities	20%	CLO3
Test	From Topics 1,2,3and 4 for Test	10%	CLO2

Reading List

Recommended Text

- **Richard T.Wright and Dorothy F.Boose 2015, *Environmental Science Toward a Sustainable Future,ISBN 10:12929202084-9*, 2nd Ed., 12, Pearson Publisher. UK**
- **Adisa Azapagic,Alan Emsley,Ian Hamerton 2015, *The environment and sustainable development .ISBN:978-0-470-86218-6,Wiley Publisher.*, 2nd Ed., 12, Wiley Publisher UK**

Reference Book Resources

- **Akkucuk/ Ulas IGI Global 2015, *Handbook of Research on Waste Management Techniques for Sustainability Technology and Engineering*, First Ed., 6, IGI Global India [ISBN: 9781466697232]**
- **Michael Boot 2016, *Biofuels from Lignocellulosic Biomass: Innovations beyond Bioethanol.John Wiley & Sons, 1 Aug 2016 – Technology and Engineering- - 330 pages ISBN: 978-3-527-33813-9,* 2nd Ed., 12, John Wiley and Sons UK [ISBN: 9783527338139]**
- **Anne Elizabeth 2010, *Environmental Engineering: Designing a Sustainable Future Technology and Engineering*, 2nd Ed., 12, Infobase Publishing UK**
- **Verma, Deepak, Jain, Siddharth, Zhang, Xiaolei, Gope, 2016, *Green Approaches to Biocomposite Materials Science and Engineering 16 Jun 2016 - Technology and Engineering*, 2nd Ed., 12, Prakash Chandra IGI Global India**
- **Mardiana Idayu Ahmad, Mazran Ismail, Saffa Riffat 2016, *Renewable Energy and Sustainable Technologies for Building and Environmental Applications: Options for a Greener Future .*, 2nd Ed., 10, Springer, UK [ISBN: 3319318403]**
- **Rudi Kohler & John O'Neill 1996, *New Technologies for the Devulcanization of Sulfur-Cured Scrap Elastomers,*, 4th Ed., 10, ACS Rubber Division Mtg US**

Article/Paper List	This Course does not have any article/paper resources
Other References	This Course does not have any other resources