BIRLA INSTITUTE OF TECHNOLOGY AND SCIENCE, PILANI
INSTRUCTION DIVISION
FIRST SEMESTER 2016-2017
COURSE HANDOUT (PART-II)

Date: 02/08/2016

In addition to Part-I (General Handout for all courses appended to the timetable), this portion gives further specific details regarding the course.

Course Code : MF F485
Name of the Course : Sustainable Manufacturing
Instructor-In-Charge : K. S. SANGWAN

I. Scope and Objective of the Course

Growing awareness and concerns about climate change, energy security and natural resource scarcity led by the rapid expansion of economic activity in the last two decades have put government and business under immense pressure to optimize the natural resources, to increase use of renewable energy and recycled material and to reduce the environmental effects involved in the production and consumption of goods and services. The primary objective of this course is to provide environmental, economical and social perspective of manufacturing processes, systems and tooling including material, energy and toxicity analysis during the various phases of product life cycle. A multidisciplinary approach will be undertaken. Collection and analysis of real world data from industry will be encouraged.

II. Textbook

1. K S Sangwan, A K Digalwar and Monica Sharma, 2011, Sustainable Manufacturing, EPH, New Delhi

III. Reference Papers

1. K S Sangwan and V K Mittal, 2015, A bibliometric analysis of green manufacturing and similar frameworks, Management of *Environmental Quality: An International Journal*, 26(4): 566-586.
2. VK Mittal and KS Sangwan, Ranking of Drivers for Green Manufacturing Implementation using Fuzzy TOPSIS method, Journal of Multi-Criteria Decision Analysis, 2015, Vol 22, No.1-2, pp. 119-130.
3. Varinder Kumar Mittal and Kuldip Singh Sangwan, Modeling Drivers for Successful Adoption of Environmentally Conscious Manufacturing, Journal of Modelling in Management, vol. 9, no. 2, 2014, pp. 127-140.
4. Varinder Kumar Mittal and Kuldip Singh Sangwan, Development of a Structural Model of Environmentally Conscious Manufacturing Drivers, Journal of Manufacturing Technology Management, vol 25, no 8, 2014, pp 1195-1208.
5. Varinder Kumar Mittal, Patricia Egede, Christoph Herrmann, Kuldip Singh Sangwan, Comparison of Drivers and Barriers to Green Manufacturing: A Case of India and Germany In: Re-engineering Manufacturing for Sustainability, eds Andrew Y.C. Nee · Bin Song · Soh-Khim Ong, pp. 723-728, 2013, Springer, Singapore.
6. Kuldip Singh Sangwan and Varinder Kumar Mittal, Fuzzy TOPSIS method for ranking barriers to environmentally conscious manufacturing implementation: government, industry and expert perspectives, International Journal of Environmental Technology and Management, vol 17, No. 1, 2014, pp 57-82

7. Varinder Kumar Mittal and Kuldip Singh Sangwan, Assessment of hierarchy and inter-relationships of barriers to Environmentally Conscious Manufacturing Adoption, World Journal of Science, Technology and Sustainable Development 10 (4), 2013, pp. 297-307
8. Varinder Kumar Mittal and Kuldip Singh Sangwan, Development of a Model of Barriers to Environmentally Conscious Manufacturing Implementation, International Journal of Production Research, vol. 52, no 2, 2014, pp 584-594.
9. KS Sangwan, VK Mittal, PJ Singh, Stakeholders for environmentally conscious technology adoption: an empirical study of Indian micro, small and medium enterprises, International Journal of Management and Decision Making 12 (1), 36-49
10. KS Sangwan, Development of a multi criteria decision model for justification of green manufacturing systems, International Journal of Green Economics 5 (3), 285-305
11. KS Sangwan, Performance value analysis for justification of green manufacturing systems Journal of Advanced Manufacturing Systems 5 (1), 59-73
12. PJ Singh, VK Mittal, KS Sangwan, Development and validation of performance measures for environmentally conscious manufacturing, International Journal of Services and Operations Management 14 (2), 197-220.
13. KS Sangwan, Evaluation of manufacturing systems based on environmental aspects using a multi–criteria decision model, International Journal of Industrial and Systems Engineering 14 (1), 40-57.
14. Yovana M.B. Saavedra, Ana P.B. Barquet , Henrique Rozenfeld , Fernando A. Forcellinic, Aldo R. Ometto, Remanufacturing in Brazil: case studies on the automotive sector, Journal of Cleaner Production, 2013, 1-10
15. AM King, SC Burgress, W Ijomah and CA McMahon, Reducing waste: repair, recondition, remanufacture or recycle?, Sustainable Development, Vol 14, 2006, 257-267.
16. Christoph Herrmann; Marcus Mansour, Marc Mateika, Strategic and Operational Life Cycle Management – Model, Methods and Activities, Proceedings of the 12th International CIRP Seminar on LCE 2005, Laboratoire 3S, Grenoble,France, April 3-5, 2005
17. KS Sangwan, AK Digalwar, V Bhakar, Life Cycle Assessment and Comparison of CRT, LCD and LED Monitors, Procedia CIRP, 2015, Vol 29, pp. 433-438. Kuldip Singh Sangwan, Vikrant Bhakar, Shilpa Naik and Sylvi Nazareth Andrat, Life cycle assessment of incandescent, fluorescent, compact fluorescent and light emitting diode lamps in an Indian scenario, Procedia CIRP, Vol 15, 2014, pp 467-472.
18. S. G. Lee, S. W. Lye and M. K. Khoo, A Multi-Objective Methodology for Evaluating Product End-of-Life Options and Disassembly, Int J Adv Manuf Technol (2001) 18:148–156
19. Nicola Morelli, Developing new product service systems (PSS): methodologies and operational tools, Journal of Cleaner Production 14 (2006)

IV. Course Contents

Topic	*Learning Objectives*	*Number of Lectures*
1. Introduction	Overview, WEEE, triple bottom concept of environment, economy and society,	3
2. Sustainable manufacturing implementation factors	Driver and barriers to sustainable manufacturing, SM stakeholders	6

Topic	*Learning Objectives*	*Number of Lectures*
2. Sustainable manufacturing design	Eco-innovation, design for environment, design for disposal, design for energy efficiency, design for material efficiency, sustainable materials, sustainable energy	5
3. Sustainable practices and matrices	Recycling, remanufacturing, reuse, resource efficiency, energy efficiency in machine tools and process chains	4
4. Life cycle management and assessment	Strategic and operational evaluation of technologies using life cycle concept, MET analysis, environmental impact assessment, various impact assessment models, life cycle costing	4
5. End of life (EOL) strategies	End-of-life strategies and product definition, reverse logistics, recycle, reuse and remanufacture	4
6. Sustainability framework	Elements and relationship	3
7. Sustainable business models	Integrated product policy, sustainable product service systems, green factories	3
8. Waste minimization	Lean and green, waste categorization, waste reduction	4
9. Case studies and practice on Umberto		6
	Total	42

V. Evaluation Scheme and Schedule

EC No.	Component	Duration	Weightage (%)	Date, time, venue	Nature
1	Mid-semester Test	90 min	25	7/10 2:00 - 3:30 PM	CB
2	Seminar		10		OB
3	Project		30		OB
4	Comprehensive exam	3 hours	35	12/12 FN	CB/OB

VI. Chamber Consultation Hour: Thursday, 5.00 PM

VII. Notices concerning the course: All notices concerning the course will be displayed on the Mechanical Engineering notice board.

VIII. Make-up Policy: Make-up will be permitted only in genuine cases with prior permission.

Instructor-In-Charge
MF F485