

Course Title:	Waste Management		
Course Code:	BETCK105F/205F	CIE Marks	50
Course Type (Theory/Practical /Integrated)	Theory	SEE Marks	50
		Total Marks	100
Teaching Hours/Week (L:T:P: S)	3:0:0:0	Exam Hours	3 hrs of Theory
Total Hours of Pedagogy	40 hours	Credits	03
Course objectives <ul style="list-style-type: none"> To learn broader understandings on various aspects of solid waste management practiced in industries. To learn recovery of products from solid waste to compost and biogas, incineration and energy recovery, hazardous waste management and treatment, and integrated waste management. 			
Teaching-Learning Process These are sample Strategies, which teacher can use to accelerate the attainment of the various course outcomes and make Teaching –Learning more effective <ol style="list-style-type: none"> 1. Include traditional teaching learning process such as Chalk and Talk using writing boards. 2. Construct graphical and pictorial representation of the subject in the form of Chart, hand-outs or PowerPoint presentations. 3. Collaborate with students how tools are applied to solve biological problems. 4. Integrate real time case studies in various scientific tools used. 5. Reflective approaches on analysing how and why the tools are used in self-reflected or published data. 6. Incorporate Inquiry based approach using demonstration, field study, experiments and project work 			
Module-1 (08)			
INTRODUCTION TO SOLID WASTE MANAGEMENT: Classification of solid wastes (source and type based), solid waste management (SWM), elements of SWM, ESSWM (environmentally sound solid waste management) and EST (environmentally sound technologies), factors affecting SWM, Indian scenario, progress in MSW (municipal solid waste) management in India. Indian and global scenario of e-waste,			
Module-2 (08)			
WASTE GENERATION ASPECTS: Waste stream assessment (WSA), waste generation and composition, waste characteristics (physical and chemical), health and environmental effects (public health and environmental), comparative assessment of waste generation and composition of developing and developed nations, a case study results from an Indian city, handouts on solid waste compositions. E-waste generation.			
Module-3 (08)			
COLLECTION, STORAGE, TRANSPORT AND DISPOSAL OF WASTES: Waste Collection, Storage and Transport: Collection components, storage-containers/collection vehicles, collection operation, transfer station, waste collection system design, record keeping, control, inventory and monitoring, implementing collection and transfer system, a case study. Waste Disposal: key issues in waste disposal, disposal options and selection criteria, sanitary landfill, landfill gas emission, leachate formation, environmental effects of landfill, landfill operation issues, a case study.			
Module-4 (08)			
WASTE PROCESSING TECHNIQUES & SOURCE REDUCTION, PRODUCT RECOVERY & RECYCLING: Purpose of processing, mechanical volume and size reduction, component separation, drying and dewatering. Source Reduction, Product Recovery and Recycling: basics, purpose, implementation monitoring and evaluation of source reduction, significance of recycling, planning of a recycling programme, recycling programme elements, commonly recycled materials and processes, a case study.			
Module-5 (08)			
HAZARDOUS WASTE MANAGEMENT AND TREATMENT: Identification and classification of hazardous waste, hazardous waste treatment, pollution prevention and waste minimization, hazardous wastes management in India. E-waste recycling.			

Course outcome (Course Skill Set)	
At the end of the course the student will be able to:	
CO1	Apply the basics of solid waste management towards sustainable development
CO2	Apply technologies to process waste and dispose the same.
CO3	Design working models to convert waste to energy
CO4	Identify and classify hazardous waste and manage the hazard
Assessment Details (both CIE and SEE)	
<p>The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks out of 50). The minimum passing mark for the SEE is 35% of the maximum marks (18 marks out of 50). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures not less than 35% (18 Marks out of 50) in the semester-end examination(SEE), and a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together.</p> <p>Continuous Internal Evaluation(CIE): Three Tests each of 20 Marks;</p> <ul style="list-style-type: none"> 1st, 2nd, and 3rd tests shall be conducted after completion of the syllabus of 30-35%, 70-75%, and 90-100% of the course/s respectively. Assignments/Seminar/quiz/group discussion /field survey & report presentation/ course project/Skill development activities, suitably planned to attain the COs and POs for a total of 40 Marks. <p>If the nature of the courses requires assignments/Seminars/Quizzes/group discussion two evaluation components shall be conducted. If course project/field survey/skill development activities etc then the evaluation method shall be one.</p> <p>Total CIE marks (out of 100 marks) shall be scaled down to 50 marks</p> <p>Semester End Examination(SEE): Theory SEE will be conducted by University as per the scheduled timetable, with common question papers for the subject (duration 03 hours)</p> <ul style="list-style-type: none"> The question paper shall be set for 100 marks. The medium of the question paper shall be English). The duration of SEE is 03 hours. The question paper will have 10 questions. Two questions per module. Each question is set for 20 marks. Students have to answer 5 full questions, selecting one full question from each module. The student has to answer for 100 marks and marks scored out of 100 shall be proportionally reduced to 50 marks. There will be 2 questions from each module. Each of the two questions under a module (with a maximum of 3 sub-questions), should have a mix of topics under that module. 	
Suggested Learning Resources:	
Books	
Text Books:	
<ol style="list-style-type: none"> Tchobaanoglous, G., Theisen, H., and Samuel A Vigil, Integrated Solid Waste Management, McGraw-Hill Publishers, 1993. Bilitewski B., Hard He G., Marek K., Weissbach A., and Boeddicker H., Waste Management, Springer, 1994. 	

Reference Books:

1. White, F. R., Franke P. R., & Hindle M., Integrated solid waste management: a life cycle inventory. McDougall, P. John Wiley & Sons. 2001
2. Nicholas, P., & Cheremisinoff, P. D., Handbook of solid waste management and waste minimization technologies, Imprint of Elsevier Science. 2005

Web links and Video Lectures (e-Resources):

- <https://nptel.ac.in/courses/105103205>
- <https://www.youtube.com/watch?v=k0ktJRoRcOA>
- <https://nptel.ac.in/courses/103/107/103107125/>
- https://onlinecourses.nptel.ac.in/noc22_ce76/preview
- https://onlinecourses.swayam2.ac.in/cec20_ge13/preview

Activity Based Learning (Suggested Activities in Class)/ Practical Based learning

- AV presentation by students (on specific topics).
- Discussion of case studies based on research findings.
- Model making and Poster presentations

COs and POs Mapping (Individual teacher has to fill up)

COs	POs											
	1	2	3	4	5	6	7	8	9	10	11	12
C01	3					3	3					
C02	3					3	3					
C03	3					3	3					
C04	3					3	3					

Level 3- Highly Mapped, Level 2-Moderately Mapped, Level 1-Low Mapped, Level 0- Not Mapped