
Maharashtra Institute of Technology
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**Proposed Honours* in Green
Technology and Sustainability
Engineering**

**Major disciplines in
Bachelor in Civil Engineering
(With effect from A.Y. 2022-23)**

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Honors in Green Technology and Sustainability Engineering

Year & Semester	Course Code	Course	Teaching Scheme Hours / Week			Examination Scheme and Marks								Credit Scheme		
			Theory	Tutorial	Practical	Mid-Sem Exam-I	Mid-Sem Exam-I	Mid-Sem Exam-I	Continuous Internal Evaluation	Teachers Assessment	Term work	Practical	Total Marks	Theory / Tutorial	Practical	Total Credit
SY IV	CED901	Green Technology	04	--	--	15	15	10	10	50	--	--	100	04	--	04
	CED971	Green Technology Laboratory	--	--	02	--	--	--	--	--	25	--	25	--	01	01
	Total		04	-	02	100					25	--	125	04	01	05
Total Credits=05																
TY V	CED902	Sustainable Materials and Green Building	04	--	--	15	15	10	10	50	--	--	100	04	--	04
	Total		04	-	-	100					--	--	100	04	--	04
Total Credits=04																
TY VI	CED903	Green Building Rating System	04	--	--	15	15	10	10	50	--	--	100	04	--	04
	CED972	Green Building Rating System Laboratory	--	--	02	--	--	--	--	--	25	--	25	--	01	01
	Total		04	--	02	100					25	--	125	04	01	05
Total Credits=05																
Final B. Tech. VII	CED904	Sustainable Engineering Concepts and Lifecycle Analysis	04	--	--	15	15	10	10	50	--	--	100	04	--	04
	Total		04	--	--	100					--	--	100	04	--	04
Total Credits=04																
Final B. Tech. VIII	CED973	Mini Project	--	--	04	--	--	--	--	--	25	25	50	--	02	02
	Total		--	--	04	--	--	--	--	--	25	25	50	--	02	02
Total Credits=02																
Total Credit for Semester IV+V+VI+VII +VIII= 20																

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Dean
Academics
Maharashtra Institute of Technology
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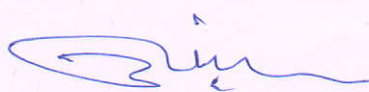
Department of Civil Engineering

Syllabus of SY B. Tech. (Honours* in Green Technology and Sustainability Engineering)

Semester-IV

Course Code: CED901	Credits: 4-0-0
Course: Green Technology	Mid Semester Examination-I: 15 Marks
Teaching Scheme:	Mid Semester Examination-II: 15 Marks
Theory: 04 Hrs/week	Continuous Internal Evaluation: 10 Marks
Tutorial: 00 Hr/week	Teacher Assessment: 10 Marks
Practical: 02 Hrs/week	End Semester Examination: 50 Marks
	End Semester Examination (Duration): 02 Hrs
Prerequisite	Basics of Environmental science, introduction to ecology, basic concepts of energy generation and conservation.
Objectives	<ol style="list-style-type: none">1. To introduce concept of green technology.2. To impart the knowledge of carbon emission.3. To introduce concept of life cycle assessment4. To learn the importance of green fuels and its impact on environment.
Unit-I	Introduction to green technology: Definition of Green Technology and its Importance, History and evolution of green technology, advantages and disadvantages of green technologies, factors affecting green technologies, Role of Industry, Government and Institutions, introduction to industrial Ecology and role of industrial ecology in green technology. <p style="text-align: right;">(08 Hrs)</p>
Unit-II	Cleaner Production (CP): Definition, Importance, Principles of Cleaner Production and its Benefits, Role of Industry, Government and Institutions in cleaner production, clean development mechanism, reuse, recovery, recycle, raw material substitution-Wealth from waste. <p style="text-align: right;">(08 Hrs)</p>
Unit-III	CP awareness and life cycle assessment: Pollution Prevention and Cleaner Production Awareness Plan, Waste audit, Environmental Statement, carbon credit, carbon trading. Introduction to Life Cycle Assessment (LCA) and Elements of LCA. <p style="text-align: right;">(08 Hrs)</p>
Unit-IV	Energy sources: Availability and need of conventional energy resources, major environmental problems related to the conventional energy resources, future possibilities of energy need and availability. Non-conventional energy sources: Solar Energy, devices and technology used in solar

	energy conversion, their principles, working and application. (08 Hrs)				
Unit-V	Green fuels: Definition of Green Fuels, their benefits and challenges, comparison of green fuels with conventional fossil fuels with reference to environmental, economic and social impacts, public policies and market driven initiatives Biomass energy: Concept of biomass energy utilization, types of biomass. (08 Hrs)				
Unit-VI	Wind, tidal and geothermal energy: Wind Energy, energy conversion technologies, their principles, and suitability in Indian context; introduction to tidal and geothermal energy and their suitability in various regions. (08 Hrs)				
References	Sr. No.	Title	Author	Publication	Edition
	1.	Pollution Prevention: Fundamentals and Practice	Paul L Bishop	McGraw Hill International	Year 2000
	2.	Pollution Prevention and Abatement Handbook – Towards Cleaner Production	World Bank Group	World Bank and UNEP, Washington D.C.	Year 1998
	3.	Cleaner Production Audit (1995)	Prasad Modak, C.Visvanathan and Mandar Parasnis	Environmental System Reviews, No.38, Asian Institute of Technology, Bangkok	Year 1995
	4.	Handbook of Organic Waste Conversion	Bewik M.W.M.	Bewik M.W.M.	1 st Edition


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Department of Civil Engineering

Syllabus of SY B. Tech. (Honours* in Green Technology and Sustainability Engineering)

Semester-IV

Course Code: CED971

Course: Green Technology Laboratory

Teaching Scheme:

Practical: 2 Hrs/week

Credits: 0-0-1

Term Work: 25 Marks

Objectives

To introduce the detailed concept of green technology and various sources of energy as alternative to conventional ones.

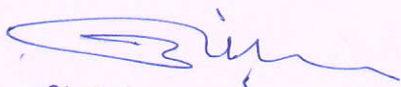
List of Practical

The following assignments need to be submitted:

1. Definition of Green Technology, its Importance and advantages and disadvantages
2. Role of industrial ecology in green technology.
3. Principles of Cleaner Production and its Benefits.
4. Clean development mechanism, Wealth from waste.
5. Carbon credit and carbon trading.
6. Introduction to Life Cycle Assessment and its Elements.
7. Comparison of conventional and Non-conventional energy sources.
8. Devices and technology used in solar energy conversion.
9. Green Fuels, their benefit and challenges.
10. Concept of biomass energy utilization, types of biomass
11. Suitability of wind, tidal and geothermal energy in Indian context.

The assessment of term work shall be done on the basis of the following.

- Continuous assessment.
- Performance of students.


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Department of Civil Engineering

Syllabus of TY B. Tech. (Honours* in Green Technology and Sustainability Engineering)

Semester-V

Course Code: CED902	Credits: 4-0-0
Course: Sustainable Materials and Green Building	Mid Semester Examination-I: 15 Marks Mid Semester Examination-II: 15 Marks
Teaching Scheme:	Continuous Internal Evaluation: 10 Marks
Theory: 04 Hrs/week	Teacher Assessment: 10 Marks
Tutorial: 00 Hr/week	End Semester Examination: 50 Marks End Semester Examination (Duration): 02 Hrs
Prerequisite	Basics concepts of green technology and sustainability, introduction to civil engineering building materials.
Objectives	The objective of this course is to expose the students to the concepts of sustainability in the context of building and conventional engineered building materials. The course also intends to make student aware of various green building councils.
Unit-I	Introduction to sustainability and green building: Introduction to sustainable materials and the concept of green building. Embodied energy and Operational energy in Building and Life cycle energy. Ecological footprint, Bio- capacity and calculation of planet equivalent. <p style="text-align: right;">(08 Hrs)</p>
Unit-II	Sustainable materials: Role of Material: Carbon from Cement, alternative cements and cementitious material, Alternative fuel for cements for reduction in carbon emission. Sustainability issues for concrete. Role of quality, minimization of natural resource utilization, High volume fly ash concrete, geo-polymer concrete etc. concrete with alternative material for sustainability. <p style="text-align: right;">(08 Hrs)</p>
Unit-III	Energy and resources consumption: Reduction in water consumption in concrete, Recycled aggregate, Energy for grinding and crushing of cement, aggregate etc. and reduction. Operational energy in building role of materials and thermal conductivity. Clay Bricks, Types of kilns, Comparative energy performance emission performance and financial performance, Indoor air quality. <p style="text-align: right;">(08 Hrs)</p>
Unit-IV	Operational energy consumption: Paints, Adhesive and sealants for use in building, Volatile organic content (VOC) emission issues and indoor air quality for Sustainability and Health hazard. Operational energy reduction and net zero building,

	Optimization for design of building for energy efficiency and example of optimization through use of Evolutionary genetic algorithm. <p style="text-align: right;">(08 Hrs)</p>				
Unit-V	Energy and resources balance: Radiation budget, Surface water balance, Effects of trees and microclimatic modification through greening. Use of Building Integrated Photo Voltaic (BIPV) and other renewable energy in buildings, basic concepts and efficiency. <p style="text-align: right;">(08 Hrs)</p>				
Unit-VI	Energy codes: ECBC requirement, Concepts of Overall Thermal Transfer Value (OTTV), Green Performance rating, requirements of Leadership in Energy and Environmental Design (LEED), Green Rating for Integrated Habitat Assessment (GRIHA) and Indian Green Building Council (IGBC). <p style="text-align: right;">(08 Hrs)</p>				
References	Sr. No.	Title	Author	Publication	Edition
	1.	Sustainability Engineering: Concepts, Design and Case Studies	Allen, D. T. and Shonnard, D. R.	Prentice Hall	1 st
	2.	Engineering applications in sustainable design and development	Bradley. A.S; Adebayo, A.O., Maria,	Cengage learning	1 st.
	3.	Environment Impact Assessment Guidelines	Notification of Government of India	2006	2006
	4.	Basic Concepts in Environmental Management	Mackenthun, K.M.	Lewis Publication London	1998
5.	GRIHA Rating System	New Delhi Bureau of Energy Efficiency	Publications- Rating System TERI Publications	ECBC Code 2007	



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Department of Civil Engineering

Syllabus of TY B. Tech. (Honours* in Green Technology and Sustainability Engineering)

Semester-VI

Course Code: CED903

Credits: 4-0-0

Course: Green Building Rating System

Mid Semester Examination-I: 15 Marks

Teaching Scheme:

Mid Semester Examination-II: 15 Marks

Theory: 04 Hrs/week

Continuous Internal Evaluation: 10 Marks

Tutorial: 00 Hr/week

Teacher Assessment: 10 Marks

Practical: 02 Hrs/week

End Semester Examination: 50 Marks

End Semester Examination (Duration): 02 Hrs

Prerequisite

Concept of green technology and energy conservation.
Introduction to sustainability.

Objectives

1. To create interest among students in green buildings and motivate them to pursue knowledge in this field.
2. To give basic introduction about various green building rating systems.
3. To give practical view of rating of green buildings through case studies.

Unit-I

Introduction of green building: Concept of green building, History of green building, Need of green building in present scenario, Importance of green building Merits and demerits, Classification of green building, Assessment methods Global assessment and certification, Local assessment, GRIHA (Green Rating for Integrated Habitat Assessment)

(08 Hrs.)

Unit-II

Rating System: LEED and IGBC rating systems, their comparison and similarities, various points calculation, ratings e.g. Silver, Gold and Platinum based on points given under various criterion.

(08 Hrs.)

Unit-III

Building Planning: Planning a building for less energy consumption, principles of planning, optimized use of natural resources with the help of sun diagram.

Plan construction activities for reduced energy consumption.

Materials: Recycled, processed, locally available, sustainable material, new age green materials.

(08 Hrs.)

Unit-IV

Elements of Green Buildings: Light, Ventilation, Water recycle & optimization, HVAC system, Electric efficiency, Finishing items, Furniture & fixtures, Low VOC

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	paint, Landscaping and its maintenance. <p style="text-align: right;">(08 Hrs.)</p>				
Unit-V	Energy conservation: Bureau of energy efficiency, its functions, policies, guidelines, Energy Conservation Building Code, Carbon footprint, carbon credits and their calculation, carbon trading, carbon emission. Zero discharge concept. <p style="text-align: right;">(08 Hrs.)</p>				
Unit-VI	Case Studies: Industrial Building, Hotel, Residential Building, Commercial complex, Educational Institute, Government building, study and report. <p style="text-align: right;">(08 Hrs.)</p>				
References	Sr. No.	Title	Author	Publication	Edition
	1.	Green Buildings: Professional guide to Concepts, Codes & Innovations,	Anthony Floyd	Cenage Learning	Handbook
	2.	Green Building Materials: A guide to product selection & specification	Ross Spiegel & Dru meadows	John Wiley & Sons	1 st Edition
	3.	Guide to Energy Conservation, energy planning for buildings	Seymour Jurnul	Mc Grow-Hill	1 st Edition
	4.	Energy efficient buildings in India	Mili Muzumdar	Ministry of Nonconventional Energy sources	Handbook



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Department of Civil Engineering

Syllabus of TY B. Tech. (Honours* in Green Technology and Sustainability Engineering)

Semester VI

Course Code: CED972

Course: Laboratory of Green Building Rating System

Teaching Scheme:

Practical: 2 Hrs/week

Credits: 0-0-1

Term Work: 25 Marks

Objectives

To introduce the detailed concept of green building rating system and energy efficiency.


List of Practical

The following assignments need to be submitted:

1. Importance of green building and its evolution.
2. Detailed criterion of LEED rating system.
3. Comparison and similarity between LEED and IGBC.
4. Principles of planning a building.
5. New age green materials.
6. Water recycling and HVAC system.
7. Landscaping and its maintenance.
8. Carbon credits and reduction in carbon emission.
9. Case study of a commercial green building.
10. Case study of a green hotel building.

The assessment of term work shall be done based on the following.

- Continuous assessment.
- Performance of students.


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Maharashtra Institute of Technology, Aurangabad (An Autonomous Institute) Department of Civil Engineering Syllabus of Final Year B. Tech. (Honours* in Green Technology and Sustainability Engineering) Semester-VII	
Course Code: CED904 Course: Sustainable Engineering Concepts and Lifecycle Analysis Teaching Scheme: Theory: 04 Hrs/week Tutorial: 00 Hr/week Practical: 00 Hrs/week	Credits: 4-0-0 Mid Semester Examination-I: 15 Marks Mid Semester Examination-II: 15 Marks Continuous Internal Evaluation: 10 Marks Teacher Assessment: 10 Marks End Semester Examination: 50 Marks End Semester Examination (Duration): 02 Hrs
Prerequisite	Introduction to the Basics concepts of sustainability, introduction to cleaner production and green technology.
Objectives	This course will introduce students to the fundamental concepts related to interaction of industrial and environmental/ecological systems. The application of life cycle assessment methodology using appropriate case studies.
Unit-I	Introduction to LCA: An Introduction to Sustainability Concepts and Life Cycle Analysis, comparison of life cycle of traditional and green construction materials, concept of Material flow and waste management, What it all means for an engineer, Water energy and food nexus. <div style="text-align: right;">(08 Hrs)</div>
Unit-II	Risk assessment and EIA: Risk and Life Cycle Framework for Sustainability, concept of Risk, Environmental Risk Assessment, Examples of risk assessment, Chemicals and Health Effects, Characteristics of Environmental Problems. Environmental Data Collection and concept of environmental impact assessment. <div style="text-align: right;">(08 Hrs)</div>
Unit-III	Methodology of LCA: Life Cycle Analysis, Detailed Methodology and ISO Framework of Life Cycle Assessment, Detailed Example on LCA Comparisons, LCA Benefits and Drawbacks, Historical Development and LCA Steps from ISO Framework: Life Cycle Inventory and Impact Assessments, Unit Processes and System Boundary Data Quality, Procedure for Life Cycle Impact Assessment. <div style="text-align: right;">(08 Hrs)</div>
Unit-IV	LCA Studies: Factors for Good LCA Study, ISO Terminologies, Life Cycle Assessment Steps Recap, Chemical Release and Fate and Transport, Green

	Sustainable Materials, study of life cycle assessment taking one example. (08 Hrs)				
Unit-V	Design for Sustainability: Environmental Design for Sustainability, Economic, Environmental Indicators, Social Performance Indicators, Sustainable Engineering Design Principles and Environmental Cost Analysis. (08 Hrs)				
Unit-VI	Case studies: Case Studies of life cycle analysis and use of sustainable materials in construction, studies like Odor Removal for Organics Treatment Plant, Comparison of Hand Drying Methods, Biofuels for Transportation, Kerosene Lamp vs. Solar Lamp, Bioplastic. (08 Hrs)				
References	Sr. No.	Title	Author	Publication	Edition
	1.	Sustainability Engineering: Concepts, Design and Case Studies	Allen, D. T. and Shonnard, D. R.	Prentice Hall	I st
	2.	Engineering applications in sustainable design and development	Bradley. A.S; Adebayo, A.O., Maria,	Cengage learning	I st
	3.	Systems Analysis for Sustainable Engineering: Theory and Applications	Ni bin Chang	McGraw-Hill Professional	Edition I
	4.	Renewable Energy Resources	Twidell, J. W. and Weir, A. D.	English Language Book Society (ELBS)	



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Department of Civil Engineering

Syllabus of Final Year B. Tech. (Honours* in Green Technology and Sustainability Engineering)

Semester-VIII

Course Code: CED973	Credits: 0-0-2
Course: Mini Project	Term Work: 25 Marks
Teaching Scheme:	Practical: 25 Marks
Practical: 04 Hrs/week	

Prerequisite Introduction to the Basics concepts of sustainability, introduction to cleaner production and green technology, green materials, life cycle analysis.

To carry out a mini project and simple prototype in the area of interest based on the knowledge gained in Green technology and sustainable engineering from undergraduate.

Every individual student will be assigned a faculty to guide them. There will be three major reviews which will be carried out as listed below:

Review #	Requirement	Marks Weightage	
		Internal	External
0	Area/ Title selection	-	-
1	Literature review, Proposal for the project.	10%	-
2	Detailed experimentation and analysis of the project work.	20%	-
3	Final interpretation of results and presentation of prototype or simulation.	20%	-
End Semester Exam	Final Viva-Voce and project demonstration.	-	50%

The assessment of term work shall be done on the basis of the following.

- Continuous assessment
- Performing the experiments in the laboratory
- Oral examination conducted on the syllabus and term work mentioned above.


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Note:

1. No additional fees will be charged for students opting for Honours/ Minor Degree
2. All the courses in the Honours/ Minor will be conducted in offline mode.
3. Re-examination is not applicable in Honours and Minor Scheme. Student failing in any of the Minor or Honours courses, at any stage will be discontinued from the Scheme.
4. Examination Scheme and Passing rules will be as per the academic rules and regulations of B. Tech.



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Honours and Minor Scheme for academic year 2022-23

- Minor and Honor Scheme is introduced with additional 4 Theory courses, two Lab Courses and one mini project with 20 Credits. MOOCs are permitted to be part of the list, so also a few PG courses. Multiple Verticals are encouraged.
- The courses from main curriculum should not be in the list of the courses for Minor/Honours.
- Host Department to float the courses from Minor/ Honours-List as One/Two in each Semester (viz. 4th,5th,6th,7th,8th semester)
- •A Student opting for 'Honours' will NOT be ENTITLED to register for 'Minor'.
- As per this scheme students will get Minor Degree and Honours along with Degree (Major) which they are pursuing.
- Regular learners can complete the B. Tech. degree with 168 credits, for Brighter and interested Students opting Honours/Minor scheme, the UG program would be of $168 + 20 = 188$ credits.
- The remedial assessment schemes such as Re-examination or summer term will NOT be applicable for Minor or Honors schemes. Student failing in any of the Minor or Honors courses, at any stage will be discontinued from the Scheme.

Sr.No.	Academic Scheme	Description
01	Minor Degree	Students can select courses from other branches. e.g. If Mechanical Engineering student selects courses from Civil Engineering under this scheme, he/she will get Major degree of Mechanical Engineering with Minor degree of Civil Engineering.
02	Honours	Students can select advanced courses from their respective branch in which they are perusing the degree. e.g. If Mechanical Engineering student selects advanced courses from same branch under this scheme, he/she will get Major degree along with Honours of Mechanical Engineering

1. Maximum batch size for minor is 30 and for Honours, it is 1/3rd of the total intake of the respective department.



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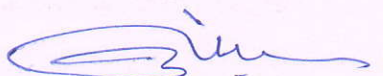
Details of this scheme are given below.

Minor Degree Scheme:

- Students can select courses from other branches. E.g. If Mechanical Engineering student selects courses from Civil Engineering under this scheme; he/she will get Major degree of Mechanical Engineering with Minor Degree of Civil Engineering.
- Student from ANY department is ELIGIBLE to apply for Minor degree from ANY OTHER DEPARTMENT.
- Student can select one course per semester from the list of courses of a branch of which he or she want to peruse Minor Degree.
- The Scheme will be started from second year 4th Semester of UG program.
- An applicant must have a minimum CGPA of 6.75 (up to 2nd Semester) and for Second Year Direct Admitted Diploma Students, with CGPA of 6.75 or equivalent.
- Mentor will be allotted from host departments to guide the students during his/her entire curriculum.
- Online courses may be selected from platforms like NPTEL/ edX/ Coursera/ Udacity/ Purdue Next/ Khan Academy/ QEEE/Udemy etc.
- While selecting the online course care must be take that it must be a certification course should be of 4/5 credits each as per the syllabus structure.
- Lab course/Internship/Mini project is permitted in Minor Scheme.

Honours Scheme:

- Students can select advanced courses from their respective branch in which they are perusing the degree. e. g. If Mechanical Engineering student selects advanced courses advanced courses from same branch under this scheme, he/she will get Major degree along with Honours of Mechanical Engineering from same branch under this scheme, he/she will get Major degree along with Honours in Mechanical Engineering.
- Students from same department are eligible for Honours.
- The Scheme will be started from second year 4th Semester of UG program.


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- An applicant must have a minimum CGPA of 6.00 (up to 2nd Semester) and for Second Year Direct Admitted Diploma Students, with CGPA of 6.00 or equivalent.
- Student can select one course per semester from the list of Honor courses of a branch in which they are perusing the degree.
- Mentor will be allotted from host departments to guide the students during his/her entire curriculum.
- Online courses may be selected from platforms like NPTEL/ edX/ Coursera/ Udacity/ Purdue Next/ Khan Academy/ QEEE/Udemy etc.
- While selecting the online course care must be take that it must be a certification course should be of 4/5 credits each as per the syllabus structure.
- Lab course/Internship/Mini -project is permitted in Honours Scheme.



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