# Certificate Course

# On

# Sustainable Engineering

**Coordinator:** Dr.B.Prashanti

**Date of Event:** 18/10/2021 to 3/11/2021

**Organizing Department:** Humanities & Sciences

# K.S.R.M. COLLEGE OF ENGINEERING

**(UGC-AUTONOMOUS)**

**Kadapa, Andhra Pradesh, India– 516 003**

**Approved by AICTE, New Delhi & Affiliated to JNTUA, Ananthapuramu.**

**An ISO 14001:2004 & 9001: 2015 Certified Institution**



Lr./KSRMCE/ H&S/Sustainable Engineering/Certification Course/2021

Date: **14.10.2021**

**To**
**The Principal,**
K.S.R.M.College of Engineering
Kadapa.

**From**
Dr.B.Prashanti,
Assistant Professor,
H&S Department
K.S.R.M.College of Engineering
Kadapa.

Respected Sir,

**Sub:** KSRMCE-Permission to conduct Certification Course on Sustainable Engineering - H&S Department- Requested - Reg.

It is being brought to your kind notice that, With reference to the cited, the H&S Department is planning to organise Certification Course on Sustainable Engineering for B.Tech Students from 18th October to 3rd November 2021. In this regard I kindly request you Sir to grant the permission for organizing Certification Course in online mode. This is submitted for your kind perusal.

Thanking you Sir,

Forwarded to principal

HOD H&S

**Yours Faithfully,**
B. Prashanti
Dr .B. Prashanti,
Assistant Professor,
H&S Department
K.S.R.M.College of Engineering
(Autonomous)

Permitted
V.S.S. Murty

# K.S.R.M. COLLEGE OF ENGINEERING

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Cr./KSRMCE/H&S Dept/Sustainable Engineering /Certification Course /2021 Date:14-10-2021

## Circular

All B.Tech students are hereby informed that Humanities and Sciences department is going to organize a certification course on Sustainable engineering for B.Tech students from 18th October 2021 to [illegible]rd November 2021. So interested students may register their names with Sustainable engineering Certification Course Coordinator Dr.B.Prashanti, Assistant professor in H&S department on or before 17th October 2021.

**HOD H&S**

Dr. I. SREEVANI M.Sc.,Ph.D
Head of Humanities & Sciences
K.S.R.M. College of Engineering
KADAPA - 516 005

Cc to:

The Director for information

All Deans/HODs

https://forms.gle/LCPkG2xfPnn3LFZMA

SUSTAINABLE ENGINEERING - 2 Certification course
KSRM COLLEGE OF ENGINEERING (Autonomous),Kadapa
Department of Humanities & Sciences

**prashanthi@ksrmce.ac.in** Switch account

Your email will be recorded when you submit this form

* Required

Name of the Student *

Your answer

Gender *
Male
Female

Branch & Section *

Your answer

College mail *

Your answer

Semester *

Your answer

Mobile number *

Your answer

Submit

Clear form

Never submit passwords through Google Forms.

**Date: 08-11-2021**

**Name of the Event:** SUSTAINABLE ENGINEERING Certificate course

**Venue:** ONLINE MODE (GOOGLECLASSROOM)

## Registred students List

| S. No | Name | Department | Contact No | Roll number |
|---|---|---|---|---|
| 1 | Peddamavireddygari chinnapeddireddy | Eee | 6301677033 | 199y1a0238 |
| 2 | Y Vikeshkumarreddy | CSE C | 6300941907 | 199y1a05i3 |
| 3 | K.CHAITANYA | CIVIL-A SECTION | 8639529154 | 199Y1A0118 |
| 4 | HACHHULUKATTE FAHEEM | Civil-a | 9347909073 | 199y1a0115 |
| 5 | A.Thulasi Deepa | Mechanical | 9100954809 | 209y1a0301 |
| 6 | Yarravagari Mohana Sree | ME | 8978838031 | 209Y1A0367 |
| 7 | S. Pavan kumar reddy | Civil-A/s | 9515414427 | 199y1a0145 |
| 8 | S.Mahammad | Civil-A | 7780742086 | 199Y1A0146 |
| 9 | MUDE CHANDU KUMAR NAIDU | Cse B section | 9347793255 | 199Y1A05A8 |
| 10 | K. ANUSHA | Ece and A/section | 8688691840 | 199Y1A0457 |
| 11 | A.LAVANYA | ECE AND A/S | 9390957255 | 199Y1A0404 |
| 12 | GADDA UPENDRA | ECE -A | 8978363986 | 199Y1A0440 |
| 13 | Kudumalavemakrishna | Cse B section | 6302640320 | 199Y1A0587 |
| 14 | Konda prathyusha | ECE_B | 8688857720 | 199Y1A0472 |
| 15 | V. Anusha | Civil and B | 9398337457 | 209y1a0191 |
| 16 | Urlagaddala poojitha | Civil & B sec | 8977177270 | 209y1a0189 |
| 17 | S.RAHAMATHULLAH | CSE C | 8688509507 | 199Y1A05F2 |
| 18 | c.sai prakash reddy a | Eec | 08688144173 | 199Y1AO425 |
| 19 | Sudheer reddy | Ece/B | 7036134057 | 199y1A04d5 |
| 20 | Nageswari pennaiahgari | Cse/c-sec | 9390458137 | 199Y1A05D1 |
| 21 | Jampala Anjali | ECE-A/S | 9347816173 | 199Y1A0455 |
| 22 | MORAM YAGNA PRIYA | CIVIL A/S | 7330651925 | 199y1a0127 |
| 23 | Challa Stephen Kumar | ECE A/S | 7286991827 | 199Y1A0419 |
| 24 | Muchukotla maneswara | Cse B | 7569995482 | 199Y1A05A7 |
| 25 | Mothukuri.Kirankumar | CSE B | 8639421764 | 199Y1A05A6 |
| 26 | C. Jashwanth varma | A | 9963187028 | 199Y1A0417 |

| | | | | |
|---|---|---|---|---|
| 27 | MUDDALAPURAM SAI SURYA | Electronics and Communication engineering / B | +917799434737 | 189Y1A0488 |
| 28 | Pullerpu obulesu | E C E B/s | 9381155228 | 189y1a04b5 |
| 29 | Dudekula Karishma | EEE | 9391512656 | 199Y1A0211 |
| 30 | SHAIK RAIESA | CSE -C | 9515780899 | 199Y1A05F3 |
| 31 | DIRASANTHA CHENANKESHAVA | CIVIL-A | 6303484138 | 199Y1A0109 |
| 32 | Shaik Mohammed Amaan | CSE C | 7288838904 | 209Y1A05F0 |
| 33 | Phatan Arfathulla Khan | CE and A/S | 9618566075 | 199Y1A0136 |
| 34 | ERLA VENKATA RAMANA | ECE C | 7680925972 | 209Y5A0403 |
| 35 | GOLLA VIJAY KUMAR YADAV | ECE C | 9014061609 | 209Y5A0405 |
| 36 | LAKKIREDDY NIHARIKA (W) | ECE C | 7065324076 | 209Y5A0410 |
| 37 | MUNAGAPATI VENKATA HARIKA (W) | ECE C | 9121446119 | 209Y5A0413 |
| 38 | PALLA VENKATA LAKSHMI (W) | ECE C | 7702524513 | 209Y5A0416 |
| 39 | SHULAM BALA SIDDARTHA | ECE C | 6309380165 | 209Y5A0418 |
| 40 | TELLADARLA MANASA (W) | ECE C | 7093492475 | 209Y5A0419 |
| 41 | ALURU LALITHA (W) | CSE A | 8297652783 | 199Y1A0504 |
| 42 | AVULA LIKHITHA (W) | CSE A | 8688564013 | 199Y1A0510 |

B. Prashanti
**Co-ordinator**

**HOD/H&S**

Dr. I. SREEVANI M.Sc.,Ph.D.
Head of Humanities & Sciences
K.S.R.M. College of Engineering
KADAPA - 516 005

| Course Title | SUSTAINABLE ENGINEERING | B. Tech :<br>Open to all branches |
|---|---|---|

**Course Objectives:**

-To develop an increased awareness among students on issues in areas of sustainability

- To make students understand the role of engineering and technology within sustainable development

- To give students some familiarity with the methods and tools used for sustainable product-service system development

- To establish in students an understanding of the role and impact of engineering activities and engineering decisions on environmental, societal, and economic well-being

**Course Outcomes:** On successful completion of this course, the students will be able to

| | |
|---|---|
| **CO 1** | Students have an increased awareness on issues in the area of sustainability |
| **CO 2** | Students get an understanding the role of engineering and technology within sustainable development |
| **CO 3** | Students gain familiarity with the methods and tools employed for sustainable product-service system development |
| **CO 4** | Students gain an understanding of the role and impact of engineering activities and engineering decisions on the environment, society, and economics |

**UNIT-I: Sustainability:** Introduction – Concepts – Need to promote sustainability – Three pillars of sustainability – Nexus between technology and sustainable development – Challenges for sustainable development -Benefits of sustainable living.

**UNIT-II: The Environment and Key Life Styles:** Food – Housing – Mobility – Consumer goods – Leisure time. Factors influencing consumption and lifestyles – Determinants – Driving factors – Motivating factors.

**UNIT-III: Natural Resources and their Pollution:** Air pollution – effects of air pollution – Clean development mechanism – Water pollution – Sustainable waste water treatment – Solid waste – sources – Impacts of solid waste – Zero waste concepts – 3R concept – Global environmental issues – Resource degradation - Climate change – Global warming - Ozone layer depletion. Carbon credits and carbon trading – Carbon foot prints.

**UNIT-IV: Life Cycle Assessment (LCA):** Introduction – LCA & Sustainability – LCA and Environmental system – LCA and Water, Food & Energy – Environmental risk assessment – Environmental data collection and LCA methods – ISO 14040 – Key points of good LCA with examples.

**UNIT-V: Design for Sustainability:** Green engineering – Sustainable engineering principles – Green sustainable materials - Sustainable urbanization – Industrial ecology – Industrial symbiosis – Case Studies.

## Reference Books:


- Alleng, D.T. and Shonnard, D.R., ***Sustainability Engineering: Concepts, Design and Case studies***, Prentice Hall
- Bradley. A.S., Adebayo, A.O., Maria, P. ***Engineering Applications in Sustainable Design and Development,*** Cengage learning.
- Ni Bin Chang, ***Systems Analysis for Sustainable Engineering: Theory and Applications***, Tata McGraw-Hill Publications.
- Purohit, S.S., ***Green Technology: An Approach for Sustainable Environment***, Agrobios Publications.


Dr. I. SREEVANI M.Sc.,Ph.D.
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K.S.R.M. College of Engineering
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## Department of Humanities & Sciences

## Sustainable engineering

**Schedule**

| Date | Timing | Course Instructor | Topic to be covered |
|---|---|---|---|
| 18-10-2021 | 4-6 pm | Dr.B.Prashanti | Need to promote sustainability – Three pillars of sustainability – Nexus between technology and sustainable development |
| 19-10-2021 | 4-6 pm | Dr.B.Prashanti | Challenges for sustainable development -Benefits of sustainable living. |
| 20-10-201 | 4-6 pm | Smt M.Mary Jasmine | Food – Housing – Mobility – Consumer goods – Leisure time. |
| 21-10-2021 | 4-6 pm | Smt M.Mary Jasmine | Factors influencing consumption and lifestyles – Determinants – Driving factors – Motivating factors. |
| 22-10-2021 | 4-6 pm | Dr.B.Prashanti | Air pollution – effects of air pollution |
| 23-10-2021 | 4-6 pm | Dr.B.Prashanti | Clean development mechanism |
| 24-10-2021 | 4-6 pm | Dr.B.Prashanti | 3R concept – Water pollution – Sustainable waste water treatment |
| 25-10-2021 | 4-6 pm | Dr.B.Prashanti | Solid waste – sources – Impacts of solid waste – Zero waste concepts |
| 26-10-201 | 4-6 pm | Dr.B.Prashanti | Global environmental issues – Resource degradation - Climate change |
| 27-10-2021 | 4-6 pm | Dr.B.Prashanti | Global warming - Ozone layer depletion. |
| 28-10-2021 | 4-6 pm | Dr.B.Prashanti | Carbon credits and carbon trading |
| 29-10-2021 | 4-6 pm | Dr.B.Prashanti | Carbon foot prints |

| | | | |
|---|---|---|---|
| | | | LCA & Sustainability |
| 30-10-2021 | 4-6 pm | Dr.B.Prashanti | LCA and Environmental system – LCA and Water, Food & Energy – Environmental risk assessment |
| 31-10-2021 | 4-6 pm | Dr.B.Prashanti | Environmental data collection and LCA methods – ISO 14040 – Key points of good LCA with examples. |
| 1-11-2021 | 4-6 pm | Smt.M.Mary Jasmine | Green engineering – Sustainable engineering principles |
| 2-11-2021 | 4-6 pm | Smt.M.Mary Jasmine | Green sustainable materials - Sustainable urbanization |
| 3-11-2021 | 4-6 pm | Smt.M.Mary Jasmine | Industrial ecosystem – Industrial symbiosis – Case Studies. |

B.Prashanti
Co-ordinator

HOD H&S

Course Instructor 1: B.Prashanti

Course Instructor 2: M. Mary Jasmine

Dr. I. SREEVANI M.Sc.,Ph.D.
Head of Humanities & Sciences
K.S.R.M. College of Engineering
KADAPA

Date: 08-11-2021

**Name of the Event:** SUSTAINABLE ENGINEERING Certificate course

**Venue :** ONLINE MODE (GOOGLECLASSROOM)

## List of Participants

| S. No | Name | Department | Contact No | Roll number |
|---|---|---|---|---|
| 1 | Peddamavireddygari chinnapeddireddy | Eee | 6301677033 | 199y1a0238 |
| 2 | Y Vikeshkumarreddy | CSE C | 6300941907 | 199y1a05i3 |
| 3 | K.CHAITANYA | CIVIL-A SECTION | 8639529154 | 199Y1A0118 |
| 4 | HACHHULUKATTE FAHEEM | Civil-a | 9347909073 | 199y1a0115 |
| 5 | A.Thulasi Deepa | Mechanical | 9100954809 | 209y1a0301 |
| 6 | Yarravagari Mohana Sree | ME | 8978838031 | 209Y1A0367 |
| 7 | S. Pavan kumar reddy | Civil-A/s | 9515414427 | 199y1a0145 |
| 8 | S.Mahammad | Civil-A | 7780742086 | 199Y1A0146 |
| 9 | MUDE CHANDU KUMAR NAIDU | Cse B section | 9347793255 | 199Y1A05A8 |
| 10 | K. ANUSHA | Ece and A/section | 8688691840 | 199Y1A0457 |
| 11 | A.LAVANYA | ECE AND A/S | 9390957255 | 199Y1A0404 |
| 12 | GADDA UPENDRA | ECE -A | 8978363986 | 199Y1A0440 |
| 13 | Kudumalavemakrishna | Cse B section | 6302640320 | 199Y1A0587 |
| 14 | Konda prathyusha | ECE_B | 8688857720 | 199Y1A0472 |
| 15 | V. Anusha | Civil and B | 9398337457 | 209y1a0191 |
| 16 | Urlagaddala poojitha | Civil & B sec | 8977177270 | 209y1a0189 |
| 17 | S.RAHAMATHULLAH | CSE C | 8688509507 | 199Y1A05F2 |
| 18 | c.sai prakash reddy a | Eec | 08688144173 | 199Y1AO425 |
| 19 | Sudheer reddy | Ece/B | 7036134057 | 199y1A04d5 |
| 20 | Nageswari pennaiahgari | Cse/c-sec | 9390458137 | 199Y1A05D1 |
| 21 | Jampala Anjali | ECE-A/S | 9347816173 | 199Y1A0455 |
| 22 | MORAM YAGNA PRIYA | CIVIL A/S | 7330651925 | 199y1a0127 |
| 23 | Challa Stephen Kumar | ECE A/S | 7286991827 | 199Y1A0419 |
| 24 | Muchukotla maneswara | Cse B | 7569995482 | 199Y1A05A7 |
| 25 | Mothukuri.Kirankumar | CSE B | 8639421764 | 199Y1A05A6 |

| | | | | |
|---|---|---|---|---|
| 26 | C. Jashwanth varma | A | 9963187028 | 199Y1A0417 |
| 27 | MUDDALAPURAM SAI SURYA | Electronics and Communication engineering / B | +917799434737 | 189Y1A0488 |
| 28 | Pullerpu obulesu | E C E B/s | 9381155228 | 189y1a04b5 |
| 29 | Dudekula Karishma | EEE | 9391512656 | 199Y1A0211 |
| 30 | SHAIK RAIESA | CSE -C | 9515780899 | 199Y1A05F3 |
| 31 | DIRASANTHA CHENANKESHAVA | CIVIL-A | 6303484138 | 199Y1A0109 |
| 32 | Shaik Mohammed Amaan | CSE C | 7288838904 | 209Y1A05F0 |
| 33 | Phatan Arfathulla Khan | CE and A/S | 9618566075 | 199Y1A0136 |

B. Prashanthi
**Co-ordinator**

**HOD H&S**

Dr. I. SREEVANI M.Sc.,Ph.D.
Head of Humanities & Sciences
K.S.R.M College of Engineering
KADAPA - 516 005

## K.S.R.M College of Engineering (Autonomous), Kadapa

### Department of Humanities & Sciences

Certificate Course on Sustainable Engineering (phase -2)

Attendance Sheet

| S.No | Name of the student | Roll No | Branch | 18/10/2021 | 20/10/2021 | 21/10/2021 | 22/10/2021 | 23/10/2021 | 25/10/2021 | 26/10/2021 | 27/10/2021 | 28/10/2021 | 29/10/2021 | 30/10/2021 | 31/10/2021 | 1/11/2021 | 2/11/2021 | 3/11/2021 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | Peddamavireddygari chinnapeddireddy | 199y1a0238 | EEE | P | P | P | P | P | P | P | P | P | P | P | P | P | P | P |
| 2 | Y Vikeshkumarreddy | 199y1a05i3 | CSE | P | P | P | P | P | P | P | P | P | P | P | P | P | P | P |
| 3 | K.CHAITANYA | 199Y1A0118 | CIVIL | P | P | P | P | P | P | P | P | A | P | P | P | P | P | P |
| 4 | HACHHOLUKATTE FAHEEM | 199y1a0115 | CIVIL | P | P | P | P | P | P | P | P | P | P | P | P | P | P | P |
| 5 | A.Thulasi Deepa | 209y1a0301 | ME | P | P | P | P | P | P | P | P | P | P | P | P | P | P | P |
| 6 | Yarravagari Mohana Sree | 209Y1A0367 | ME | P | P | P | P | P | P | P | P | P | P | P | P | P | P | P |
| 7 | S. Pavan kumar reddy | 199y1a0145 | CIVIL | P | P | P | P | P | P | P | P | P | P | P | P | P | P | P |
| 8 | S.Mahammad | 199Y1A0146 | CIVIL | P | P | P | P | P | P | P | P | P | P | P | P | P | P | P |
| 9 | MODE CHANDU KUMAR NAIDU | 199Y1A05A8 | CSE | P | P | P | P | P | P | P | P | P | P | P | P | P | P | P |
| 10 | K. ANUSHA | 199Y1A0457 | ECE | P | P | P | P | A | P | P | P | P | P | P | P | P | P | P |
| 11 | A.LAVANYA | 199Y1A0404 | ECE | P | P | P | P | P | P | P | P | P | P | P | P | P | P | P |
| 12 | GADDA UPENDRA | 199Y1A0440 | ECE | P | P | P | P | P | P | P | P | P | P | P | P | P | P | P |
| 13 | Kudumalavemakrishna | 199Y1A0587 | CSE | P | P | P | P | P | P | P | P | P | P | P | P | P | P | P |
| 14 | Konda prathyusha | 199Y1A0472 | ECE | P | P | P | P | P | P | P | P | P | P | P | P | P | P | P |
| 15 | V. Anusha | 209y1a0191 | CIVIL | P | P | P | P | P | P | P | P | P | P | P | P | P | P | P |
| 16 | Urlagaddala poojitha | 209y1a0189 | CIVIL | P | P | P | P | P | P | P | P | P | P | P | P | P | P | P |
| 17 | S.RAHAMATHULLAH | 199Y1A05F2 | CSE | P | P | P | P | P | P | P | P | P | P | P | P | P | P | P |
| 18 | c.sai prakash reddy a | 199Y1A0425 | ECE | P | P | P | P | P | P | A | P | P | P | P | P | P | P | P |
| 19 | Sudheer reddy | 199y1A04d5 | ECE | P | P | P | P | P | P | P | P | P | P | P | P | P | P | P |
| 20 | Nageswari ponnaiahgari | 199Y1A05D1 | CSE | P | P | P | P | P | P | P | P | P | P | P | P | P | P | P |
| 21 | Jampala Anjali | 199Y1A0455 | ECE | P | P | P | P | P | P | P | P | P | P | P | P | P | P | P |
| 22 | MORAM YAGNA PRIYA | 199y1a0127 | CIVIL | P | P | P | P | P | P | P | P | P | P | P | P | P | P | P |
| 23 | Challa Stephen Kumar | 199Y1A0419 | ECE | P | P | P | P | P | P | P | P | P | P | P | P | P | P | P |
| 24 | Muchukotla maneswara | 199Y1A05A7 | CSE | P | P | P | P | P | P | P | P | P | P | P | P | P | P | P |
| 25 | Mothukuri.Kirankumar | 199Y1A05A6 | CSE | P | P | P | P | P | P | P | P | P | P | P | P | P | P | P |
| 26 | C. Jashwanth varma | 199Y1A0417 | ECE | P | P | P | P | P | P | P | P | P | P | P | P | P | P | P |
| 27 | MUDDALAPURAM SAI SURYA | 189Y1A0488 | ECE | P | P | P | P | P | P | P | P | P | P | P | P | P | P | P |
| 28 | Pullerpu obulesu | 189y1a04b5 | ECE | P | P | P | P | P | P | P | P | P | P | P | P | P | P | P |
| 29 | Dudekula Karishma | 199Y1A0211 | EEE | P | P | P | P | P | P | P | P | P | P | P | P | P | P | P |
| 30 | SHAIK RAIESA | 199Y1A05F3 | CSE | P | P | P | P | P | P | P | P | P | P | P | P | P | P | P |
| 31 | DIRASANTHA CHENANKESHAVA | 199Y1A0109 | CIVIL | P | P | P | P | P | P | P | P | P | P | P | P | P | P | P |
| 32 | Shaik Mohammed Amaan | 209Y1A05F0 | CSE | P | P | P | P | P | P | P | P | P | P | P | P | P | P | P |
| 33 | Phatan Arfathulla Khan | 199Y1A0136 | CIVIL | P | P | P | P | P | P | P | P | P | P | P | P | P | P | P |

B. Prasanthi
Coordinator

HOD

Dr. I. SREEVANI M.Sc., Ph.D.
Head of Humanities & Sciences
K.S.R.M. College of Engineering
KADAPA

# K.S.R.M. COLLEGE OF ENGINEERING

**(UGC - Autonomous)**

Kadapa, Andhra Pradesh, India– 516 003

Approved by AICTE, New Delhi & Affiliated to JNTUA, Ananthapuramu.

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KSNR

*lives on..*

## Department of H&S

## *Certificate course on Sustainable Engineering*

**Date**

**18 th October to 3rd November , 2021**

**Eligibility: All branches of B.Tech students**

**Venue: Online Mode**

**Course Co-ordinator :**

Dr.B.Prashanti

**Course Instructors:**

Dr.B.Prashanti

M .Mary jasmine

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## ACTIVITY REPORT

**Certification Course**

**On**

"Sustainable Engineering"

**18th October to 3rd November ,2021**

**Target Group** : **B. Tech Students**

**Details of Participants** : **33 Students**

**Co-ordinator** : **Dr.B.Prashanti**
**Asst. Prof, Dept. of H&S**

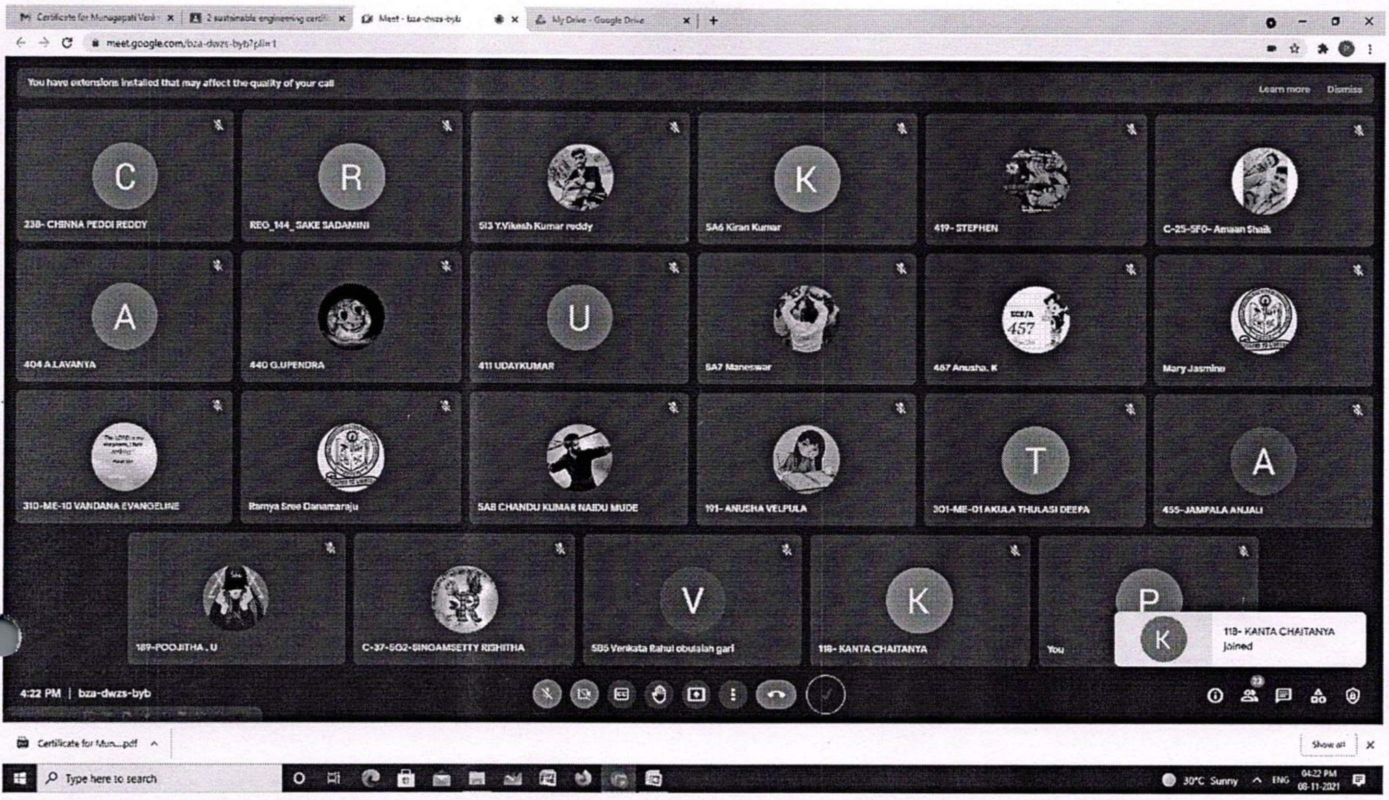
**Organizing Department** : **Department of Humanities & Sciences**

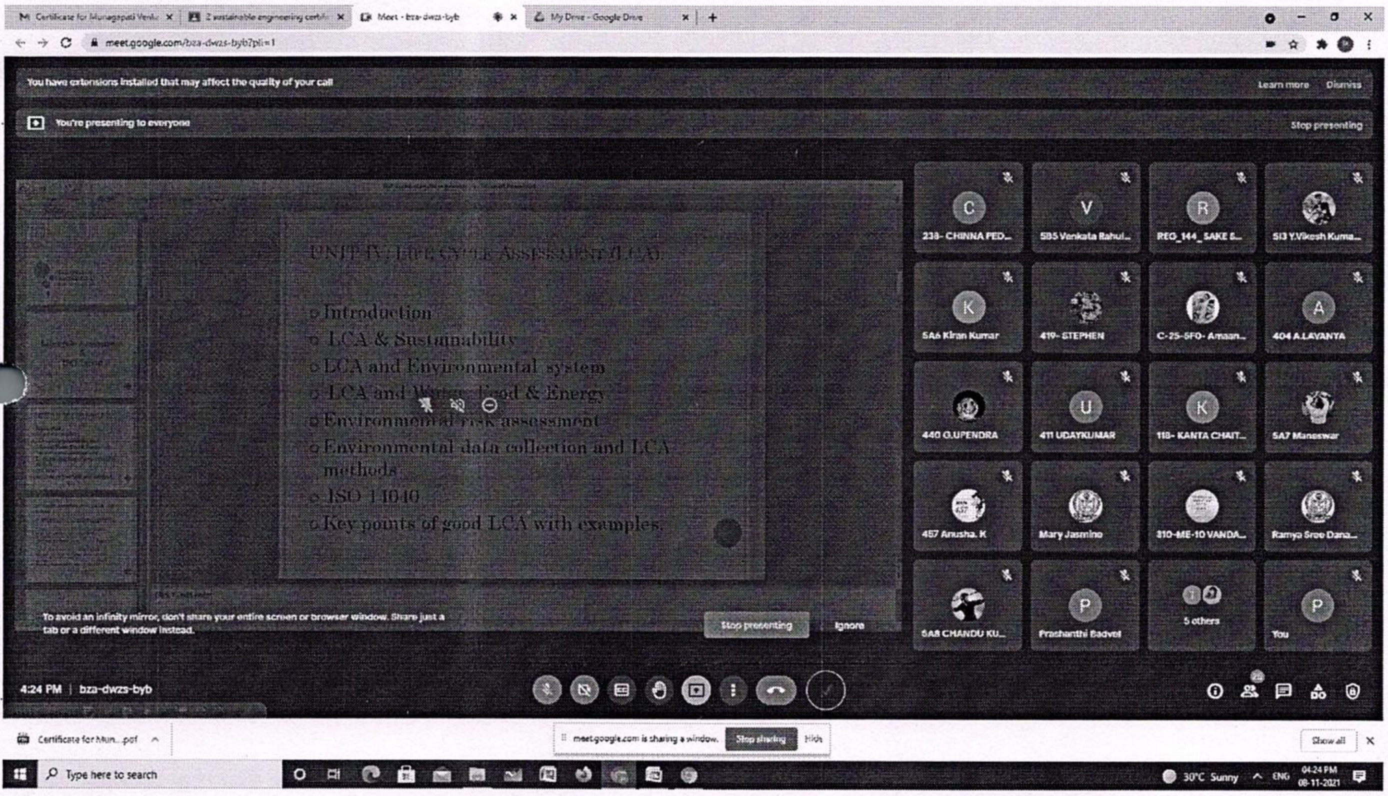
**Venue** : **Online mode (Google meet)**

https://classroom.google.com/c/NDA2MDA5OTYyMTQz?cjc=bhwlems
**https://meet.google.com/bza-dwzs-byb**

**Description** : Certification course on "Sustainable Engineering " was organized by Dept. of H&S from **18thOctober to 3rd November ,** 2021 in online mode. The Course instructors are Dr. B. Prashanti &Smt.M.Mary jasmine. The main aim of the course is to create awareness among students about this course of Sustainability practices applied in various fields like Engineering and Industrial applications to conserve environment. Course is completed and certificates are provided for the participants.

**Photo :**






B Prashanti
**Dr. .B. Prashanti**
**Coordinator**

**Dr. I.Sreevani**
**HOD H&S**

Dr. I. SREEVANI M.Sc.,Ph.D.
Head of Humanities & Sciences
K.S.R.M. College of Engineering
KADAPA - 516 005

**K.S.R.M COLLEGE OF ENGINEERING(Autonomous),**
**Andhra pradesh,Kadapa-516003**
**Approved by AICTE,New Delhi,JNTUA**


# *Certificate of Appreciation*

This is to certify that Mr./Ms./Smt. **Peddamavireddygari chinnapeddireddy** has successfully completed the certificate course on **Sustainable Engineering** organised by **Department of Humanities & Sciences,K.S.R.M.C.E** from 18th October to 3rdNovember , 2021.

**Dr.I.Sreevani , HOD**

**Principal, K.S.R.M.C.E**

# K.S.R.M COLLEGE OF ENGINEERING(Autonomous),
Andhra pradesh,Kadapa-516003
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## *Certificate of Appreciation*

This is to certify that Mr./Ms./Smt. **A.LAVANYA** has successfully completed the certificate course on **Sustainable Engineering** organised by **Department of Humanities & Sciences,K.S.R.M.C.E** from 18th October to 3rd November , 2021.

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**KSNR**
*lives on..*

# Certificate of Appreciation

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**Dr.I.Sreevani , HOD**

**Principal, K.S.R.M.C.E**

# Feedback Form & Certification details for Certification course on Sustainable engineering (October 18 to 3 November 2021)

K.S.R.M COLLEGE OF ENGINEERING (Autonomous) , Kadapa , Andhra Pradesh ,India-516003
Approved by AICTE , New Delhi & Affiliated to JNTUA , Anantapuramu
We appreciate your help in evaluating the session on certification course on the parameters mentioned below using a scale from 1 (Low) to 5 (High ). You will receive the certificate based on your feedback.
Your email will be recorded when you submit this form
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Full name *

Your answer

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Your answer

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DEPARTMENT OF HUMANITIES AND SCIENCES

SUSTAINABLE ENGINEERING (PHASE-2) CERTIFICATE COURSE FEEDBACK FORM

| Timestamp | Full name | Branch and se | Roll number | Contact Numb | 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|---|---|---|---|
| 11-8-2021 21:36:53 | P chinnapeddireddy | Eee | 199y1a0238 | 6301677033 | 4 | 4 | 5 | 5 | 6 |
| 11-8-2021 21:37:09 | Y Vikeshkumarreddy | CSE C | 199y1a05i3 | 6300941907 | 5 | 5 | 5 | 5 | 6 |
| 11-8-2021 21:42:02 | K.CHAITANYA | CIVIL-A/S | 199Y1A0118 | 8639529154 | 4 | 4 | 4 | 5 | 4 |
| 11-8-2021 21:46:08 | HACHHULUKATTE FAHEEM | Civil-a | 199y1a0115 | 9347909073 | 5 | 5 | 5 | 5 | 6 |
| 11-9-2021 12:07:43 | A.Thulasi Deepa | Mechanical | 209y1a0301 | 9100954809 | 5 | 5 | 5 | 5 | 6 |
| 11-9-2021 12:08:34 | Yarravagari Mohana Sree | ME | 209Y1A0367 | 8978838031 | 5 | 5 | 5 | 5 | 6 |
| 11-9-2021 12:45:36 | S. Pavan kumar reddy | Civil-A/s | 199y1a0145 | 9515414427 | 5 | 3 | 3 | 3 | 5 |
| 11-9-2021 12:47:30 | S.Mahammad | Civil-A | 199Y1A0146 | 7780742086 | 5 | 5 | 5 | 5 | 6 |
| 11-9-2021 15:55:55 | MUDE CHANDU KUMAR NAIDU | Cse B section | 199Y1A05A8 | 9347793255 | 5 | 5 | 5 | 4 | 5 |
| 11-9-2021 16:03:06 | K. ANUSHA | ECE A/s | 199Y1A0457 | 8688691840 | 5 | 3 | 4 | 3 | 5 |
| 11-9-2021 16:08:34 | A.LAVANYA | ECE A/S | 199Y1A0404 | 9390957255 | 5 | 4 | 3 | 2 | 5 |
| 11-9-2021 16:11:07 | GADDA UPENDRA | ECE -A | 199Y1A0440 | 8978363986 | 5 | 4 | 4 | 4 | 5 |
| 11-9-2021 16:46:58 | Kudumalavemakrishna | Cse B/S | 199Y1A0587 | 6302640320 | 4 | 4 | 5 | 5 | 6 |
| 11-9-2021 17:08:02 | Konda prathyusha | ECE_B | 199Y1A0472 | 8688857720 | 4 | 4 | 3 | 4 | 5 |
| 11-9-2021 17:10:15 | V. Anusha | Civil and B | 209y1a0191 | 9398337457 | 5 | 5 | 4 | 4 | 6 |
| 11-9-2021 17:12:46 | Urlagaddala poojitha | Civil & B sec | 209y1a0189 | 8977177270 | 5 | 5 | 5 | 5 | 6 |
| 11-9-2021 17:13:42 | S.RAHAMATHULLAH | CSE C | 199Y1A05F2 | 8688509507 | 5 | 5 | 5 | 5 | 5 |
| 11-9-2021 17:29:22 | c.sai prakash reddy a | Eec | 199Y1AO425 | 08688144173 | 5 | 5 | 5 | 5 | 6 |
| 11-9-2021 17:50:56 | Sudheer reddy | Ece/B | 199y1A04d5 | 7036134057 | 4 | 4 | 4 | 4 | 5 |
| 11-9-2021 17:52:14 | Nageswari pennaiahgari | Cse/c-sec | 199Y1A05D1 | 9390458137 | 4 | 3 | 5 | 3 | 5 |
| 11-9-2021 18:06:54 | Jampala Anjali | ECE-A/S | 199Y1A0455 | 9347816173 | 4 | 4 | 5 | 3 | 3 |
| 11-9-2021 18:14:36 | MORAM YAGNA PRIYA | CIVIL A/S | 199y1a0127 | 7330651925 | 5 | 4 | 4 | 4 | 5 |
| 11-9-2021 18:18:26 | Challa Stephen Kumar | ECE A/S | 199Y1A0419 | 7286991827 | 4 | 4 | 4 | 5 | 6 |
| 11-9-2021 19:19:45 | Muchukotla maneswara | Cse B | 199Y1A05A7 | 7569995482 | 5 | 5 | 1 | 3 | 6 |
| 11-9-2021 19:19:53 | Mothukuri.Kirankumar | CSE B | 199Y1A05A6 | 8639421764 | 3 | 4 | 3 | 3 | 4 |
| 11-9-2021 22:10:16 | C. Jashwanth varma | A | 199Y1A0417 | 9963187028 | 1 | 1 | 1 | 1 | 1 |
| 11-10-2021 11:07:03 | MUDDALAPURAM SAI SURYA | ECE/ B | 189Y1A0488 | +9177994347 | 5 | 5 | 5 | 5 | 6 |
| 11-10-2021 11:09:23 | Pullerpu obulesu | E C E B/s | 189y1a04b5 | 9381155228 | 5 | 5 | 4 | 5 | 6 |
| 11-11-2021 17:33:49 | Dudekula Karishma | EEE | 199Y1A0211 | 9391512656 | 1 | 2 | 1 | 1 | 4 |
| 11-11-2021 18:50:06 | SHAIK RAIESA | CSE -C | 199Y1A05F3 | 9515780899 | 4 | 4 | 4 | 4 | 5 |
| 11-12-2021 9:00:43 | DIRASANTHA CHENANKESHAVA | CIVIL-A | 199Y1A0109 | 6303484138 | 5 | 5 | 5 | 5 | 6 |
| 11-17-2021 18:40:50 | Shaik Mohammed Amaan | CSE C | 209Y1A05F0 | 7288838904 | 5 | 5 | 5 | 5 | 6 |
| 11-23-2021 20:37:39 | Phatan Arfathulla Khan | CE A/S | 199Y1A0136 | 9618566075 | 5 | 5 | 5 | 5 | 6 |

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B prashanti
Co-ordinator.

Dr. I. SREEVANI M.Sc.,Ph.D.
Head of Humanities & Sciences
K.S.R.M. College of Engineering
K A D A P A - 516 005

# Sustainable Engineering

Certification course

Kandula Sreenivasa Reddy Memorial College Of Engineering (Autonomous),Kadapa

Dr.B.Prashanti

Assistant professor

## CERTIFICATE COURSE ON SUSTAINABLE ENGINEERING

- **Course Objectives:**
- To have increased awareness among engineering students on sustainability
- To know the environment & key lifestyles and their influencing factors
- To understand the various types of environmental pollutions and their sustainable solutions
- To have a better perception of life cycle assessment and environmental risk assessment.
- To develop sustainable practices by utilizing the engineering knowledge and principles
- To become critical and proactive thinkers and, with this, successful engineers in the field
- **UNIT-I: Sustainability:** Introduction – Concepts – Need to promote sustainability – Three pillars of sustainability – Nexus between technology and sustainable development – Challenges for sustainable development -Benefits of sustainable living.
- **UNIT-II: The Environment and Key Life Styles:** Food – Housing – Mobility – Consumer goods – Leisure time. Factors influencing consumption and lifestyles – Determinants – Driving factors – Motivating factors.

- **UNIT-III: Natural Resources and their Pollution:** Air pollution – effects of air pollution – Clean development mechanism – Water pollution – Sustainable waste water treatment – Solid waste – sources – Impacts of solid waste – Zero waste concepts – 3R concept – Global environmental issues – Resource degradation - Climate change – Global warming - Ozone layer depletion. Carbon credits and carbon trading – Carbon foot prints.
- **UNIT-IV: Life Cycle Assessment (LCA):** Introduction – LCA & Sustainability – LCA and Environmental system – LCA and Water, Food & Energy – Environmental risk assessment – Environmental data collection and LCA methods – ISO 14040 – Key points of good LCA with examples.
- **UNIT-V: Design for Sustainability:** Green engineering – Sustainable engineering principles – Green sustainable materials - Sustainable urbanization – Industrial ecology – Industrial symbiosis – Case Studies.

- **Reference Books:**

- Alleng, D.T. and Shonnard, D.R., ***Sustainability Engineering: Concepts, Design and Case studies***, Prentice Hall
- Bradley. A.S., Adebayo, A.O., Maria, P. ***Engineering Applications in Sustainable Design and Development,*** Cengage learning.
- Ni Bin Chang, ***Systems Analysis for Sustainable Engineering: Theory and Applications***, Tata McGraw-Hill Publications.
- Purohit, S.S., ***Green Technology: An Approach for Sustainable Environment***, Agrobios Publications.

## Introduction

- Humans make hundreds of thousands of decisions during the course of their lives.
- For the lucky among us, those decisions will vary wildly.
- What food will I eat?
- what house will I live in?
- How will I get to work in the morning?
- What type of clothes will I wear?
- How will I spend my spare time?
- The list is endless.

- No matter how we choose to answer these questions, the lifestyles we end up living .
- In some cases, are forced to live – have a profound impact on our planet.
- Affecting everything from how our economies grow to the health of our environment.
- Our consumption habits are putting our resources levels at great risk.

- The amount of stuff we use in order to live has exploded in many parts of the world.
- Highlighted by the fact that the global extraction of materials has tripled over the past four decades,
- rising to an enormous100 billion tonnes in 2020.
- If current trends continue, then this dramatic increase in the amount of material
- we consume will continue to rise as populations grow, the middle class expands, and incomes increase.

## Concepts on sustainability

- 'Sustainable development
- fulfills the needs of the present without compromising the ability of the future generations to meet their own needs.'
- As people become richer and are able to afford more, they are more likely to want to have access to recreation and this means clean water and air, unpolluted land, natural ecosystems etc.
- Thus, jobs, or development, is a critical vehicle in eliminating environmental degradation.

## Sustainable engineering

- Sustainable engineering is the process of using resources in a way that does not compromise the environment or deplete the materials for future generations.
- Sustainable engineering requires an interdisciplinary approach in all aspects of engineering and it should not be designated as a sole responsibility of environmental engineering.
- All engineering fields should incorporate sustainability into their practice in order to improve the quality of life for all.

- One way of measuring the socio-economic improvement of societies is the Millennium Development Goals.
- Through creating and maintaining the physical infrastructures that help eradicate extreme poverty and hunger, achieve universal primary education, reduce child mortality and improve maternal health,
- Engineers are demonstrating their social and environmental responsibility to sustainably develop societies.

- creation of the Sustainable Development Goals, engineers will continue to play a decisive role in their success.
- The necessity for environmentally-friendly technologies in the future will require the expertise of engineers.
- Therefore, the UNESCO Engineering Initiative (UEI) is working with partners to develop engineering curricula that incorporate sustainability as an overarching theme.

- Recently, the UEI in partnership with the Association of German Engineers, the German Commission for UNESCO and leading German educational facilities and companies,
- created the Quality Engineering for Sustainability initiative.
- This initiative aims to develop North-South-South partnerships by integrating sustainability topics into engineering education.

# Need to promote Sustainability

- Satat Bharat – Sanatan Bharat (Sustainable India) India's climate action strategies call for clean and efficient energy systems, disaster resilient infrastructure, and planned eco-restoration.
- Acting on its nationally-determined contributions, India has electrified 100% of its villages,
- reduced 38 million tonnes of $CO_2$ emissions annually through energy efficient appliances
- provided clean cooking fuel to 80 million poor households, and set a target to install 450GW of renewable energy and
- restore 26 million hectares of degraded land by 2030.
- Globally, India stands third in renewable power, fourth in wind power, and fifth in solar power.
- India launched the Coalition for Disaster Resilient Infrastructure and
- the International Solar Alliance to leverage global partnerships for climate action and disaster resilience.

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- In the spirit of South-South Cooperation, for realizing the 2030 Agenda
- India supports developing countries through the USD 150 million India-UN Development Partnership Fund.
- In this spirit of regional and global partnerships, and the country's commitment to 'leave no one behind'
- India steps into the Decade of Action, drawing confidence from its experience in addressing challenges.
- Government of India will continue to work collaboratively with all domestic and global stakeholders to accelerate efforts for a sustainable planet for future generations.

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## Three Pillars of Sustainability

1. Environment Pillar
   – Sustainable development can only exist if conservation is embraced more fully than wasting resources or preservation of all resources
2. Economy Pillar
   – Efforts to set prices of commodities and goods based not only on supply and demand but also on costs to the environment.
3. Society Pillar
   – Modifying the wants of cultures in regards to shelter, food, and clothing to objects that are sustainable

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## Nexus between technology and Sustainable development

- https://www.eli.org/international-programs/technologies-sustainable-development
- Hardware, software, know-how, and other technologies are an essential tool for sustainable development. They can be instrumental in ensuring that people:
- have access to clean water (through water purification, efficiency, delivery, and sanitation technologies);
- have access to energy that is clean, affordable, and sustainable (e.g., through energy-efficient technologies and technologies that use alternative sources of energy);

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## Technology and Sustainable development

- live in a less toxic environment (e.g., by putting in place alternative agricultural and industrial technologies
- That reduce the quantity and toxicity of the raw materials and processes, as well as treatment techniques);
- live in a more stable environment by mitigating the effects of climate change
- (e.g., more energy-efficient processes and emissions control) and

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- Adapting to climate change (e.g., using GIS to assist in land use planning); and
- Are able to more effectively and efficiently manage natural resources;
- Have effective environmental governance regimes (e.g., in monitoring compliance and enforcement,
- Providing public access to information, building capacity, and raising public awareness).

- One of greatest challenges that countries —
- especially developing countries — face in realizing sustainable development is
- obtaining and putting in place the necessary technologies.
- While access to technology depends to some extent on financial resources, it is not only a financial issue.
- In many instances, legal and institutional frameworks impede the development

- Import/export, transfer, and use of technologies for sustainable development.
- Quotas and tariffs can affect the ability to import technologies.
- Similarly, subsidies may promote the use of technologies that may waste energy, water, or other resources.
- Moreover, decision makers should consider cultural norms when selecting and putting in place technologies.

- seeks to promote the development, import/export, transfer, and use of technologies for sustainable development. We will:
- examine legal, institutional, and other barriers to the effective application of technologies;
- identify innovative approaches to promote technologies for sustainable development, drawing upon lessons
- learned from experiences to date (what works, in what contexts, why, how, …); and

- understand the legal, socio-economic, and political factors
- that may affect the effectiveness of initiatives to obtain and implement particular technologies.
- work with local partners to identify challenges to the development, import, and
- use of technologies, and possible solutions to help put in place the necessary technologies.
- These collaborations will entail a combination of research, capacity building, and legal and technical assistance.

## Challenges for Sustainable development

- Degrading Air Quality Index
- Rampant Environmental Degradation
- Loss of Biodiversity
- Urbanization in Himalayas
- Loss of Resilience in Ecosystems
- Lack of Waste Management
- Depletion of Resources (land ,air ,water ,forest , minerals etc)
- Growing Water scarcity

## Benefits of Sustainable Living

- Save Money
- Reduce Energy consumption
- Generate your own power
- Cut back on water use
- Grow your own food
- Reuse, buy recycled products

## UNIT II

- **The Environment and Key Life Styles:**
- Food
- Housing
- Mobility
- Consumer goods
- Leisure time
- Factors influencing consumption and lifestyles
- Determinants
- Driving factors
- Motivating factors.

## Environment and key lifestyles

Sustainable lifestyle:

"sustainable lifestyle" is a cluster of habits and patterns of behaviour embedded in a society .

- Facilitated by institutions, norms and infrastructures that frame individual choice
- In order to minimize the use of natural resources and generation of wastes
- while supporting fairness and prosperity for all.

## Creating sustainable lifestyles

- Requires a change in social norms and in the design of the systems that support lifestyles.
- It means rethinking our ways of living – including how we buy and organize our everyday lives.
- There are also implications for how we socialize, exchange, share, educate, and develop our identities.
- At the macro level, it is about transforming societies to better meet people's needs in balance with the natural environment.

- As citizens, at home and at work,
- the choices we make on food, housing, mobility
- consumer goods (including clothes and appliances, etc.),
- leisure (including tourism products and services)
- communication, and interaction contribute to building sustainable lifestyles.
- (This is an updated definition based on UNEP (2010), the Taskforce on Sustainable Lifestyles (Sweden, n.d.).

## Food

- What we eat and drink – how it is produced, processed and provided –
- how we dispose of it have impacts on the environment and society
- People make decisions related to food based on both objective
- subjective factors, including cost, freshness, health impacts,
- presentation (e.g., packaging), place of origin, convenience, taste, and culture
- At the use phase in the food system

- some factors that have impacts on the environment include outlet of purchase, storage period and facilities,
- preparation process, and consumption.
- Apart from environmental impacts, concerns around lifestyles and
- food include health, obesity, an increasing number and intensity of allergies
- social impacts of agricultural practices

- Globally, almost a third of food harvested is wasted or lost;
- Due to changing dietary trends;
- particularly in urban environments which increasingly favor more resource intensive (GHG producing) foods such as processed foods and meats.
- This occurs in a global context where 1 in 9 people are hungry and 2 in 10 are obese.
- There is clearly potential to shift to more sustainable patterns.

- Cities can encourage more sustainable diets that ensure adequate nutrition
- while reducing environmental footprint,
- raising awareness, and changing behavior around food waste.
- Enacting policies in planning, housing and transportation can also support more sustainable low carbon food systems
- encourage more sustainable local food production such as backyard and community gardens

# Housing

- How we live, where we live, what is used to build,
- Heat and cool our living spaces and what we install in our houses
- Have social and environmental impacts.
- The building sector contributes up to 30 per cent of global annual greenhouse gas emissions
- uses up to 40% of all energy (UNEP, 2009).

- In order to address this, we need innovative solutions on
- what future buildings and cities will look like.
- Building construction requires resources such as sand, wood and metals.
- Many of the materials require preprocessing and some of them are sourced through mining.

- The mining process alone causes biodiversity loss, deforestation
- Emissions of GHGs and use of hazardous chemicals.
- People make decisions related to housing
- Based on both objective and subjective factors
- cost and size of the building, building characteristics
- aesthetics, the neighbourhood, and available amenities
- While living in houses we use energy and water, and dispose of waste:

- important energy considerations include
- efficiency insulation
- heating or cooling
- The way neighborhoods are built affects many aspects of society
- including the rate of crime
- commuting distances
- opportunities for neighbors
- to create strong ties
- form vibrant communities

## Mobility

- What forms of transport we choose, how often we travel
- The transport sector is responsible for 13 per cent of greenhouse gas emissions
- 23% of CO2 emissions from global energy consumption (GEF-STAP, 2010).
- Citizens make mobility decisions based on cost, choice of transportation mode,
- Mode of transportation is particularly significant
- flying tends to have the highest environmental impact, followed by private car use.

- Other factors, such as distance covered, number of people in the vehicle per use,
- For example, policy responses can include combinations of measures that discourage unnecessary transportation,
- adopt more sustainable modes of transport, and improve existing systems of transport.
- CONVENIENCE, CLEANLINESS, EFFICIENCY, ACCESS, AESTHETIC.

## Consumer goods

- The products we buy, the type and quantity of materials that are used in producing them,
- how we use them, and how often we replace them have impacts on society and the environment.
- Examples include electric and electronic appliances, clothing
- Products which tend to have the highest impacts are those produced using mined materials and fossil fuels.
- Consumer goods are important because of their daily use and their role in defining our image and habits.

## Leisure

- How we spend leisure time, our choice of tourism destinations and activities,
- and the facilities we use have significant contributions to the environment and society.
- Leisure embodies a wide variety of activities –
- from meditation and reading to flying and watching television; or swimming, golfing,
- The expanding role in modern lifestyles of electric and electronic products
- e.g. mobile phones and other information communication products
- means related environmental impacts are increasing, through the growth of electronic waste, pollution
- mining of rare earth metals.

- These consumption patterns have huge implications for resource scarcity and pollution,
- with impacts that vary according to fabrics, dyes, chemicals, transportation, and packaging method used.
- Clothes help us to define who we are and what we stand for, and are connected to our daily lives on a very personal level.
- With women spending tens to hundreds of hours shopping for clothing every year,
- fashion has the unique ability to be a highly visible engine for change and even a medium for consumer education.
- weekend trips, and owning second homes.
- Each reflects different levels of materialism and social interaction.
- Staying at and using the services of a five-star hotel, for example, has a higher impact than staying in a three-star hotel.

## Key messages from research on sustainable lifestyles

- There is no universal sustainable lifestyle. What is sustainable in one locality may not be sustainable in another
- Lifestyles occur within – and are enabled and constrained by – social norms and the physical environment.
- It is important to differentiate between the factors that can be addressed at the individual or the household level, and those that are beyond individual control (Akenji, 2014) .

- As society evolves, or becomes more complex and/or affluent, what constitute basic social needs evolve.
- For example, a mobile phone was perceived as a luxury two decades ago, now it is a perceived need for most adults in industrialized cities, yet it remains a luxury in some parts of the developing world
- Beyond sities enabling basic neces and needs to operate with dignity within a society, increases in income not directly translate into happiness.

- Efforts must be made to address the extremes of poverty and wealth in society
- in order to ensure sustainable lifestyles.
- Manifestations of social tension get stronger as the disparity of economic conditions
- between the social classes get wider (Death, 2014; Hilton, 2007)
- The environmental impacts of lifestyles are not intentional but rather a consequence of people aspiring to fulfil needs and desires, as well as to function in society.
- It is important to examine how society is organized to provide for the wellbeing of citizens (Shove, 2006; Spaargaren, 2004)

- Knowledge or awareness of sustainable consumption and lifestyle options does not usually lead to intended actions
- This knowledge-action or intention-behavior gap suggests that awareness is easily subordinated by lack of access or lock-in to available options
- Top-down approaches to changing lifestyles will only succeed with participation of civil society.
- Bottom-up approaches, including social innovations, social movements

## Influencing factors of consumption and lifestyles

- There is vast literature addressing lifestyles and consumption and sustainability (Akenji, 2014; T Jackson, 2005; Mont & Power, 2013; OECD, 2002; Tukker, Cohen, Hubacek, & Mont, 2010; Vergragt, Akenji, & Dewick, 2014).
- Though the study of lifestyles is not new, looking at "sustainable" lifestyles increases the complexity of intervening factors and their interdependence.
- This is because sustainability (unlike health, safety and ethics) is not a criterion engrained in operations of many communities,
- the impacts are not felt immediately or directly, and the translation from theory to policy and practice remains ineffective.
- What works or does not work is still subject to experiment and debate.
- There is consensus that, to have more effective sustainable lifestyles policies and practices,
- it is critical to get context-specific to understand why people consume and what shapes their related behaviors.

- This context-specific understanding can be derived through three interlinked underlying lifestyle factors: i) motivations; ii) drivers; and iii) determinants.
- These should be the focus of policies, institutional frameworks,
- programmes and infrastructure when influencing lifestyle design.
- i. Motivations refer to the immediate personal and social reasons and justifications
- that compel people and society to take certain actions or make certain decisions –
- e.g. the desire to spend time with friends and family, or the seductive presentation of a product.
- ii. Drivers refer to circumstances that support motivation, normalizing it, or making it practicable – e.g. cultural norms or media marketing.
- iii. Determinants are super-factors that decide on the possibility of lifestyle or consumer action.
- Three key determinants explain types of lifestyles:
- attitudes, facilitators (access), and infrastructure.

## Motivations of lifestyle

- Why do people consume?
- Studies and empirical evidence suggest that people do not consume
- with the intention to harm the environment.
- Resulting environmental impacts are an unintended consequence of the pursuit of well-being.
- To meet basic needs e.g. nutrition and subsistence, health, housing , mobility
- To fulfil social functions/expectations e.g. convenience, connectedness, maintaining relationships, traditions •

- To satisfy personal desires, preferences and tastes e.g. leisure, food preferences, consumer goods (electronics or cars) •
- Due to the influence of advertising/marketing e.g. creation of new product markets such as pet food and cosmetics, planned obsolescence, or enhanced functionality such as mobile phones that do more than make calls and •

- The widely referenced Needs-Opportunities-Ability model looks at consumption from the macro-level of society and the micro-level of the household (Gatersleben & Vlek, 1998; OECD, 2002).
- It assumes that given the opportunities and the necessary abilities, people would pursue fulfilling their needs and desires to improve their quality of life.
- According to Vlek, needs include relationships, development, comfort, work, health, money, status and safety.
- Max-Neef , in his widely accepted work (Max-Neef , 1991), has identified some universally present needs:
- subsistence, protection, affection, understanding, participation, recreation, creation, identity and freedom.
- These resonate with the motivation behind consumption and lifestyles

# Drivers of lifestyles

- Lifestyles and consumption are governed by a set of complex and dynamic drivers
- reflect the personal situation (income, identity, individual taste, and values)
- and external socio-technical and economic conditions
- (culture, social context, peer pressures, etc.).
- There are also physical or natural boundaries
- which allow or constrain lifestyle options.
- Studies on consumer decision-making in several fields show that

- cognitive abilities, psychological, social, economic and
- policy and institutional frameworks all come into play
- highlighting that driving factors behind lifestyles are inter-linked, and sometimes contradictory.

- In essence, how we fulfil needs and wants (lifestyles) is framed by factors that range from the personal situation, through the enablers or constraints of broader external sociotechnical conditions, to ultimately physical and natural boundaries. Defra (2011) has referred to this as a distinction between behavioural factors and situational factors.

## Below some of the main lifestyle drivers

- Income level: This is one of the strongest lifestyle indicators and drivers of consumption.
- More disposable income means greater affordability of goods and services and easier access to more credit, that can further consumerism
- In addition, there is compounded social pressure to maintain lifestyle levels once adopted.
- ii. Values: Values are powerful determinants of attitudes and actions (Brodhag, 2010).

# UNIT-III: Natural Resources and their Pollution:

- Air pollution – effects of air pollution
- Clean development mechanism
- Water pollution
- Sustainable waste water treatment –
- Solid waste
- sources
- Impacts of solid waste

- Zero waste concepts
- 3R concept
- Global environmental issues
- Resource degradation
- Climate change
- Global warming
- Ozone layer depletion
- Carbon credits and carbon trading
- Carbon foot prints.

## Air pollution

- **Air pollution** is a mixture of solid particles and gases in the **air**.
- Car emissions, chemicals from factories, dust, pollen and mold spores may be suspended as particles.

## Effects of Air pollution

- Long-term **health effects** from **air pollution**
- heart disease
- lung cancer
- respiratory diseases
- emphysema

## clean development mechanism

- The **clean development mechanism was** designed to meet a dual **objective**
- Help developed countries fulfill their commitments to reduce emissions
- Assist **developing** countries in achieving sustainable **development.**

## Goals of CDM

- It has two **main** goals:
- one, to assist countries without emissions targets ( **developing** countries) in achieving sustainable **development.**
- Two, help those countries with emission reduction targets under Kyoto (developed countries) in achieving compliance by allowing them to purchase offsets created by **CDM** projects.

## Water pollution

- Is the contamination of water bodies, usually as a result of human activities.
- Water bodies include for example
- lakes, rivers, oceans, aquifers and groundwater.
- Water pollution results when contaminants are introduced into the natural environment.

## Sustainable waste water treatment

- The centralized sewage treatment technologies expensive, complex
- failing to cater to the total wastewater generated.
- The untreated/partially treated wastewater makes its way to the water body causing
- immense degradation of the ecosystem
- environmental health.

## Decentralized sewage treatment

- The decentralized sewage treatment can be both electro-mechanical system
- higher energy requirement or natural systems
- less or no energy requirement.

## CSE- CENTRE FOR SCIENCE AND ENVIRONMENT

- CSE has reviewed and documented select case studies that
- present innovative, sustainable and affordable ways
- treating the sewage locally
- reuse/recycle.

- The case studies comprise of the wastewater treatment systems implemented at
- individual
- community/cluster
- municipal level

## Vambay scheme

- The housing project is funded under the Vambay scheme
- Its objective
- improved sanitation situation in the community.
- sewage streams are conveyed
- houses
- collected

- The treated wastewater is
- reused for landscaping
- safe disposal of wastewater
- helps in reduction of Environmental pollution
- Biogas produced
- used by the colony residents for cooking

## Solid waste

- **Solid wastes** from industries are a **source** of toxic metals, hazardous **wastes**, and chemicals.

## Solid waste sources

- Eight main sources of solid wastes are as follows:
- 1. Municipal solid wastes
- 2. Industrial Solid Wastes
- 3. Mining solid wastes

- 4. Fertilizers
- 5. Pesticides and Biocides
- 6. Excretory products of humans and livestock
- 7. Electronic wastes
- 8. Hospital Wastes.

## Impacts of solid waste

- An inefficient municipal **solid waste** management system
- Negative environmental **impacts**
- infectious diseases
- land and water pollution
- obstruction of drains
- loss of biodiversity

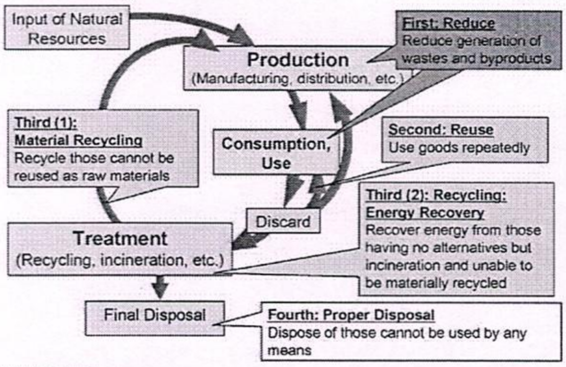
## https://en.wikipedia.org/wiki/Zero_waste

- **Zero Waste** is a set of principles focused on waste prevention that encourages the redesign of resource life cycles so that all products are reused.

- The goal is for no trash to be sent to landfills, incinerators or the ocean.

- Currently, only 9% of plastic is actually recycled.
- In a zero waste system, material will be reused until the optimum level of consumption.

# 3 r concept




# Key Global Environmental Problems

- 1 **Global** Warming. ...
- 2 Ozone Depletion and Destruction. ...
- 3 Sharp Decrease of Forest Cover. ...
- 4 Declining of Biological Diversity. ...
- 5 Acid Rain Pollution. ...
- 6 Land Desertification. ...
- 7 Marine Pollution and Damage. ...
- 8 Water Pollution and Freshwater Resource Shortage.

# Resource degradation

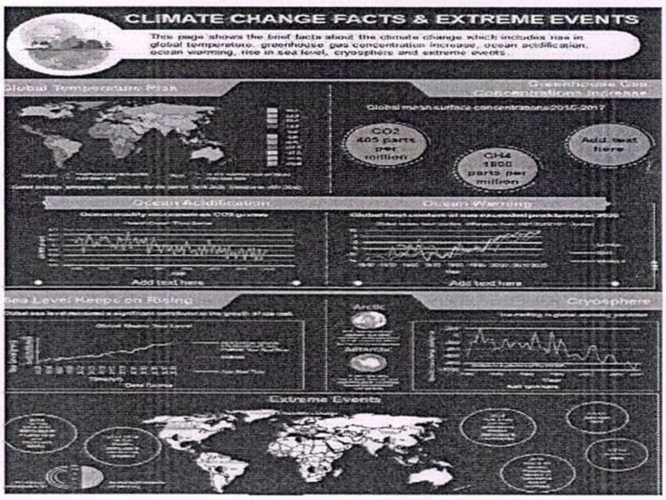
- Due to the increasing global population, the levels of **natural resource degradation** is also increasing. ...

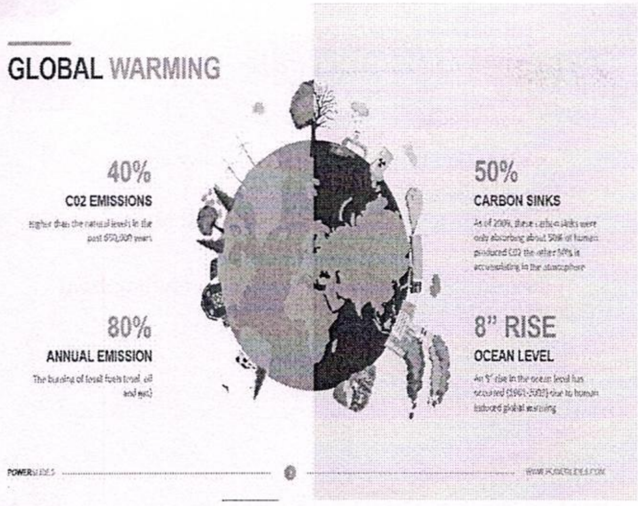
**Causes of Depletion of Natural Resources**

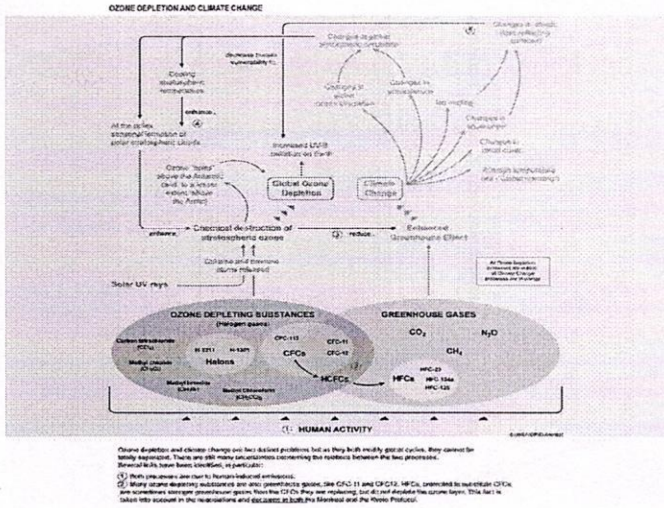
- Overpopulation. ...
- Poor Farming Practices. ...
- Logging. ...
- Overconsumption of **Natural Resources**. ...
- Pollution. ...
- Industrial and Technological Development.

# Climate change

- Environmental problem
- water shortages
- loss of biodiversity
- waste management.






## carbon credit

- **1 carbon credit** corresponds to **1** metric tonne of **carbon** dioxide prevented from entering the atmosphere.

- Carbon credits allow companies to compensate for their greenhouse gas emissions.
- Now a new blueprint offers a route to create a universally comparable standard for much carbon they save.

- By paying someone else to either reduce their emissions or capture their carbon
- companies can compensate for their environmental footprint
- use carbon credits to get to carbon-neutral status

## Calculation of carbon credit earned

On considering the average value of 0.932 tonnes of $CO_2$ emission reduction per megawatt-hour of electricity

- $CO_2$ emission reduction per megawatt-hour per year as per the **calculation** will be
- $0.353 \times 0.932 = 0.33$ tonnes

## carbon credit tradable permit

- A carbon credit is a tradable permit or certificate that provides
- the holder of the credit the right to emit one ton of carbon dioxide or an equivalent of another greenhouse gas –
- it's essentially an offset for producers of such gases.
- The main goal for the creation of carbon credits is the reduction of emissions of carbon dioxide and other greenhouse gases from industrial activities to reduce the effects of global warming.

## Types of carbon credit

- Those from reduced emissions (typically energy efficiency measures)
- Removed emissions (carbon capture and planting forests)
- And avoided emissions (for example refraining from cutting down rainforests).

- They can purchase carbon credits to comply with the emission cap.
- Companies that achieve the carbon offsets (reducing the emissions of greenhouse gases) are usually rewarded with additional carbon credits.
- The sale of credit surpluses may be used to subsidize future projects for the reduction of emissions.

- The introduction of such credits was ratified in the Kyoto Protocol.
- The Paris Agreement validates the application of carbon credits and sets the provisions for the further facilitation of the carbon credits markets.

## Types of Carbon Credits

- **Voluntary emissions reduction (VER):** A carbon offset that is exchanged in the over-the-counter or voluntary market for credits.
- **Certified emissions reduction (CER):** Emission units (or credits) created through a regulatory framework with the purpose of offsetting a project's emissions.
- The main difference between the two is that there is a third party certifying body that regulates the CER as opposed to the VER.

## certified emissions reductions (CERs)

- product that can be used as investments in the credits CERs are sold by special carbon funds
  large financial institutions
- The carbon funds provide small investors opportunity to enter the market

## Trading Credits

- Carbon credits can be traded on both private and public markets. Current rules of trading allow the international transfer of credits.
- The prices of credits are primarily that specialize in the trading of the credits, including
- European Climate Exchange
- NASDAQ OMX Commodities Europe exchange
- European Energy Exchange.

- Other organizations have cut the bulk of their emissions and used credits to compensate for those they cannot avoid.
- Credits are generally traded in units of 1 tonne of $CO_2$, and it's estimated that credits worth 2 billion tonnes of $CO_2$ will be needed to get to the 2030 target.

## Carbon credits in action

- The Katingan Project in Indonesia is one such scheme. In 2007, two environmental entrepreneurs began persuading local farmers to abstain from clearing virgin forest in return for selling carbon credits from their land.
- Today, it's the world's largest forest-based avoided-emissions project.
- The project says it has prevented the release of more than 37 million tonnes of $CO_2$ and saved 200,000 hectares of rare peat swamp forest,
- which is home to five critically endangered species including the Borneo orangutan.

- Europe's most energy-intensive industries, including airlines operating flights between EU member countries, can already use carbon credits to meet mandatory limits on their emissions under the EU Emissions Trading Scheme (EU ETS) which has been operating since 2005.

## carbon footprint

- A **carbon footprint** is the total amount of greenhouse gases (including **carbon** dioxide and methane) that are generated by our actions.
- The average **carbon footprint** for a person in the United States is 16 tons, one of the highest rates in the world.

- Throughout a product's lifetime, or lifecycle, different greenhouse gases GHGs
- may be emitted
- carbon dioxide ($CO_2$)
- methane ($CH_4$)
- nitrous oxide ($N_2O$)
- each with a greater or lesser ability to trap heat in the atmosphere.

- These differences are accounted for by calculating the global warming potential (GWP) of each gas
- in units of carbon dioxide equivalents ($CO_2e$), giving carbon footprints a single unit for easy comparison.
- See the Center for Sustainable Systems "Greenhouse Gases Factsheet" for more information on GWP.
- A typical U.S. household has a carbon footprint of 48 metric tons $CO_2e$/yr.[2]

## SOURCES OF EMISSIONS
## FOOD

- Food accounts for 10-30% of a household's carbon footprint, typically a higher portion in lower-income households.
- Production accounts for 68% of food emissions, while transportation accounts for 5%.
- Food production emissions consist mainly of $CO_2$, $N_2O$, and $CH_4$, which result primarily from agricultural practices.
- Meat products have larger carbon footprints per calorie than grain or vegetable products because of the inefficient transformation of plant energy to animal energy,
- and due to the methane released from manure management and enteric fermentation in ruminants.

# Life cycle Assessment
# &
# ISO 14040

## UNIT-IV: Life Cycle Assessment (LCA):

- Introduction
- LCA & Sustainability
- LCA and Environmental system
- LCA and Water, Food & Energy
- Environmental risk assessment
- Environmental data collection and LCA methods
- ISO 14040
- Key points of good LCA with examples.

## Life Cycle Assessment (LCA) is defined

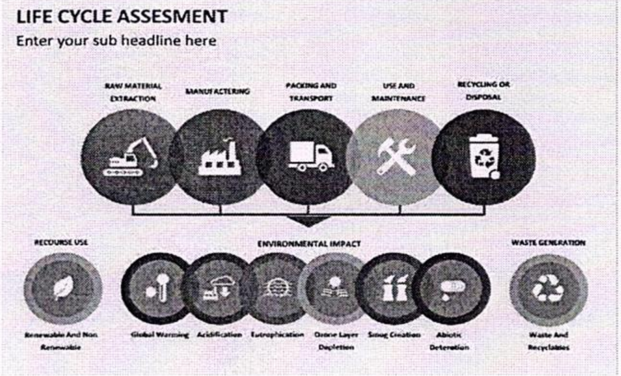
- " as the systematic analysis of the potential environmental impacts of products or services during their entire life cycle".

- During a Life Cycle Assessment (Life Cycle Analysis),
- Evaluate the potential environmental impacts
- Throughout the entire life cycle of a product
- (production, distribution, use and end-of-life phases) or service.
- This also includes the upstream (e.g., suppliers) and downstream (e.g., waste management) processes
- associated with the production (e.g., production of raw, auxiliary and operating materials),
- use phase
- disposal (e.g., waste incineration).

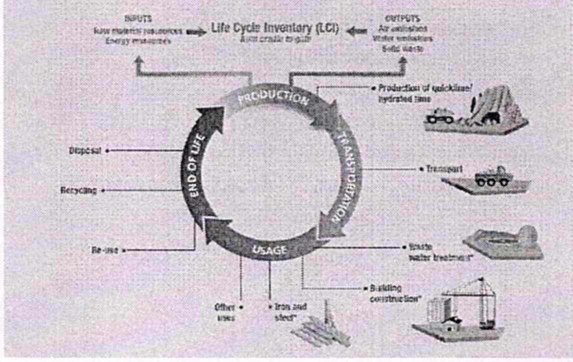
## LCA

- LCA is a tool for quantifying the environmental performance of products taking into account the complete life cycle
- starting from the production of raw materials to the final disposal of the products
- Including material recycling if needed.

## LCA &Sustainability

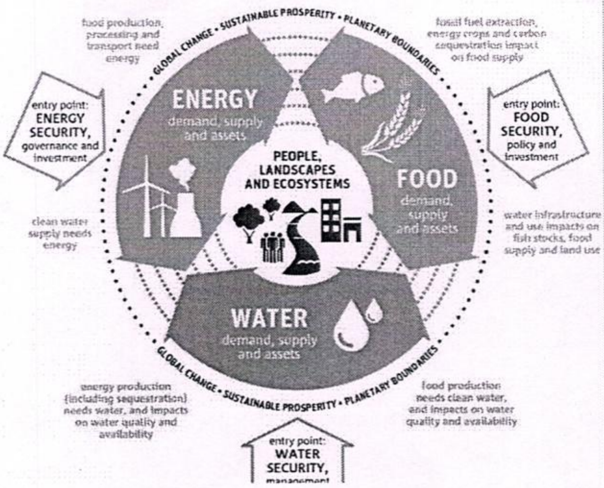



## Environmental data collection and LCA methods



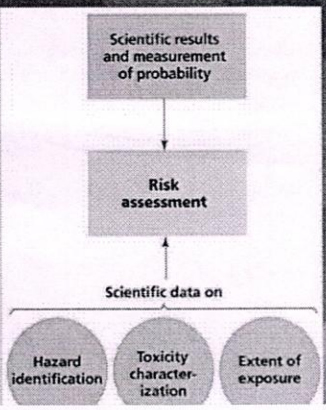
# LCA and Environmental system

**LCA and Water, Food & Energy**




## Risk Assessment

- Involves:
  - ✓ Dose-response analysis or other tests of toxicity
  - ✓ Assessing likely exposure to the hazard *(concentration, time, frequency)*




## Applications of Life Cycle Assessment

- The most important applications for an LCA are:
- Identification of improvement opportunities through identifying environmental hot spots in the life cycle of a product.
- Analysis of the contribution of the life cycle stages to the overall environmental load, usually with the objective of prioritizing improvements on products or processes.

## Life cycle impact assessment (LCIA)

- covers all relevant inputs from the environment
- e.g., ores and crude oil, water, land use
- emissions into air, water and soil
- e.g., carbon dioxide and nitrogen oxides
- The International Organization for Standardization
- conducting a Life Cycle Assessment according to ISO 14040 and 14044.

## ISO 14040 STANDARD

ISO 14040 → Environmental management: life cycle assessment

ISO 14040: framework → Nella 14040 general requirement of consistency with the requirements met in the new standard

ISO 14044: → only one standard

ISO 14041: → definition of the objective and scope of the analysis, compilation of an inventory of inputs and outputs of a given system

ISO 14042: → evaluation of potential environmental impacts related to these input and output

ISO 14043 → Finally, the interpretation of results

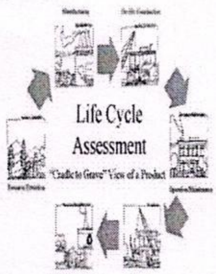
Gabriella Arcese

## Key points of Good LCA with examples

### Life Cycle Assessment of buildings

Buildings became a major target for environmental improvement as building sector accounted for nearly

- 40% of the world's energy consumption,
- 30% of raw material use and
- 33% of the related global greenhouse gas (GHG) emissions.

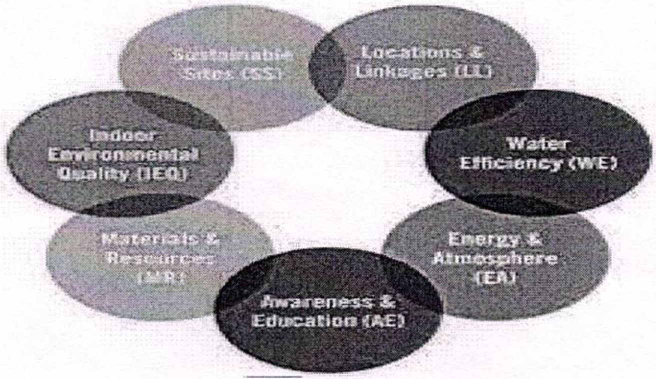


# Unit V

- **Design for Sustainability:**
- Green engineering
- Sustainable engineering principles
- Green sustainable materials
- Sustainable urbanization
- Industrial ecology
- Industrial symbiosis
- Case Studies

https://bioplasticsnews.com/2020/01/14/orange-peel-mushrooms-building-materials/

# Design for sustainability




# Green engineering

https://www.accessscience.com/content/green-engineering/299903

- Green engineering involves
- Design of products, processes, and systems
- manageable costs
- minimize environmental impacts.

# Sustainable engineering principle

https://www.e-education.psu.edu/eme504/node/5 s

- Strive to ensure that material/energy inputs and outputs not hazardous
- Waste minimization over waste management.
- Design for easy separation and purification.
- Designed for maximum mass, energy, and temporal efficiency.
- Avoid unnecessary consumption of mass/energy versus.
- Use entropy and complexity as guidelines to decide end-of-cycle.

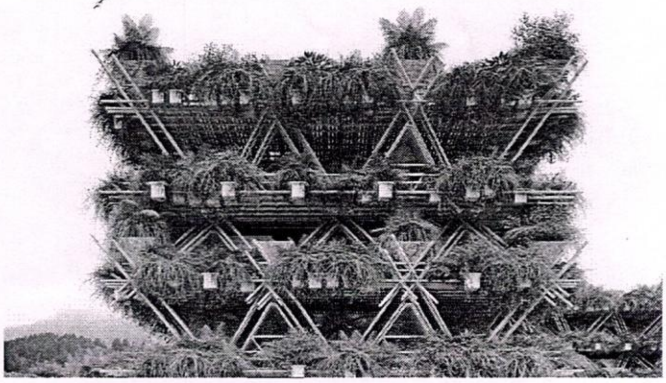
- A product must not outlast its uses.
- Not have unnecessary capabilities/capacities.
- Minimize material diversity.
- Product creation is only one part of the cycle.
- Evaluate products based on life-cycle analysis.
- Prioritize the use of renewable and readily available resources.

## Green sustainable materials

https://www.architectmagazine.com/technology/material-strategies-for-sustainable-construction_o

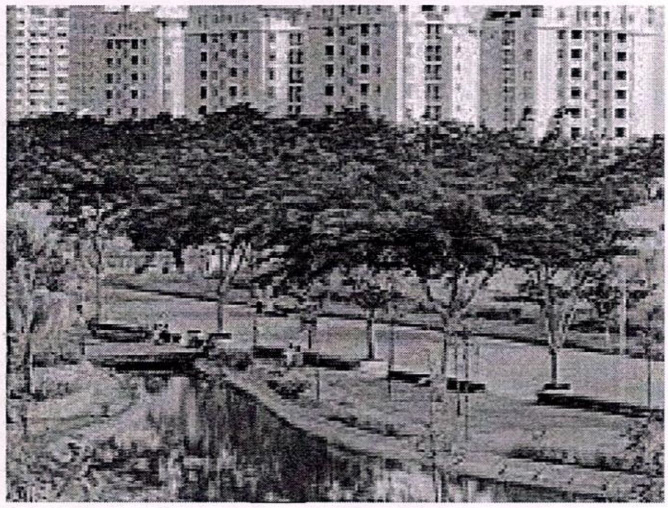
- Buildings with a significant amount of biomass-based materials (sustainably harvested, of course) may therefore be viewed as carbon banks.
- Beijing-based Penda's 2015 Beijing Design Week contribution Rising Canes,
- an adaptable, multistory construction system that uses nothing but bamboo and natural fiber rope—two biomass products
- that require minimal processing and therefore maximize this kind of literal carbon accounting in architecture.

*Rising Canes, a proposal for multistory bamboo construction by Beijing firm Penda*



## Sustainable urbanization

- **Green** urbanism has been defined as the practice of creating communities beneficial to humans and the environment.
- According to Timothy Beatley, it is an attempt to shape more **sustainable** places, communities and lifestyles, and consume less of the world's resources.



## Industrial Ecology (IE)

- is a field of study focused on the stages of the production processes of goods and services from a point of view of nature, trying to mimic a natural system by conserving and reusing resources (Chertow, 2008).

## principles of industrial ecology

- Defined by Tibbs (1992) are:
  Create **industrial** ecosystems - close the loop; view waste as a resource; create partnerships with other **industries** to trade by-products which are used as inputs to other processes.

- **Industrial ecology** was popularized in 1989 in a Scientific American article by Robert Frosch and Nicholas E. Gallopoulos.