UNIT V

ENERGY EFFICIENT PROCESSES: Environmental impact of the current manufacturing practices and systems, benefits of green manufacturing systems, selection of recyclable and environment friendly materials in manufacturing, design and implementation of efficient and sustainable green production systems with examples like environmental friendly machining, vegetable based cutting fluids, alternate casting and joining techniques, zero waste manufacturing.

GREEN BUILDINGS: Definition, features and benefits. Sustainable site selection and planning of buildings for maximum comfort. Environmental friendly building materials like bamboo, timber, rammed earth, hollow blocks, lime & lime pozzolana cement, agro materials and industrial waste, Ferro cement and Ferro-concrete, alternate roofing systems, paints to reduce heat gain of the buildings. Energy management.

Outcome: Understanding selection of eco-friendly material, machine and process for manufacturing

GREEN BUILDING

Introduction

In the "GREEN" factors an architect or designer attempts to safeguard are - air, water and land by choosing eco-friendly building materials land air water and construction practices. An architect has the ability to change entire building process with the stroke of a pen by specifying a material with low carbon dioxide emissions in its fabrication

"Green Architecture "as a concept of sustainability, especially in office building because the energy needs to operate this type is very big (air condition system - lighting-elevators-power equipment- machines) all those systems need energy so if we save any energy and get renewable energy specially in design process and construction process. (Fig .2)

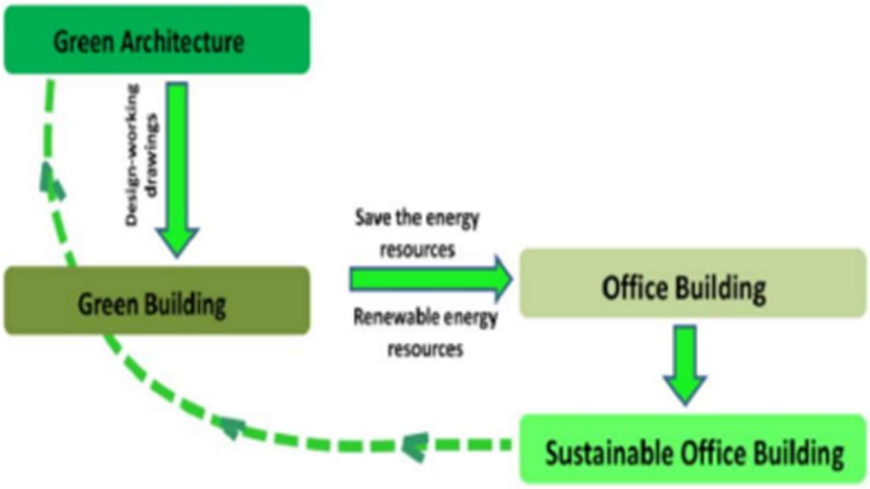

Fig .2. Green Architecture

Definitions of "Green Architecture":

Green architecture, or green design, is an approach to a building that minimizes harmful effects on human health and the environment.

What is "Green" Design?

Design and construction practices that significantly reduce or eliminate the negative impact of buildings on the environment and occupants in five broad areas:

Sustainable site planning

Safeguarding water and water efficiency

Energy efficiency and renewable energy

Conservation of materials and resources

Indoor environmental quality

➢ Energy efficient buildings means energy savings, a better environment, more comfort, reduced electricity bill and additional carbon revenue

➢ Sustainable buildings are structures that are built in an environmentally responsible manner by maximizing use of materials, minimizing use of resources and ensuring the health and well-being of occupants and the surrounding built environment both today and for generations to come.

The Principles of Green Building Design:

The green building design process begins with an intimate understanding of the site in all its

beauties and complexities. An ecological approach to design aims to integrate the systems being introduced with the existing on-site ecological functions performed by mother nature. These ecological functions provide habitat, respond to the movements of the sun, purify the air as well as catch, filter and store water. Designers can create features in their buildings that mimic the functions of particular eco-systems. Species that thrive in natural ecosystems may also utilize habitats created in man-made structures. Creating new habitat on structures in urbanized areas is especially important to support bio-diversity and a healthy ecosystem.

Design considerations:

Planning

Reduced site disturbance Waste water management.

Storm water management.

Landscape and Exterior Design to reduce heat islands.

Light Pollution Reduction.

Reduced Car dependence through carparking provision. (Fig .3).

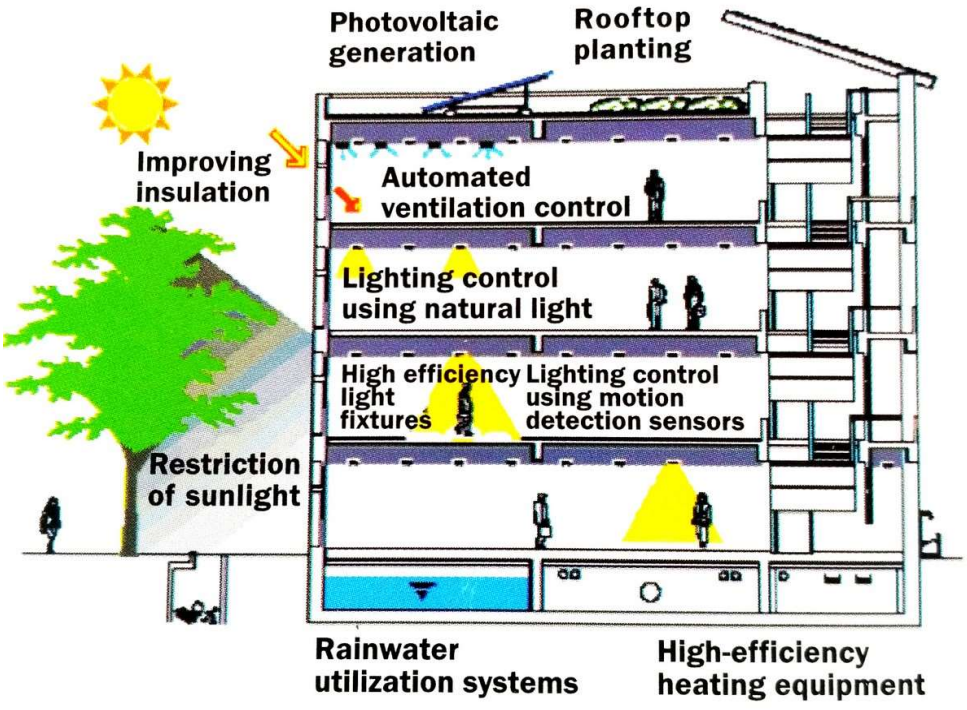

Fig.3. Conceptual Drawing of Green Building

Water Systems

Water - often called the source of life - can be captured, stored, filtered, and reused. It provides a valuable resource to be celebrated in the process of green building design. According to Art

Ludwig in Create an Oasis out of Grey water, only about 6% of the water we use is for drinking. There is no need to use potable water for irrigation or sewage. The Green Building Design course introduces methods of rainwater harvesting, grey water systems, and living pools. (Fig .4)

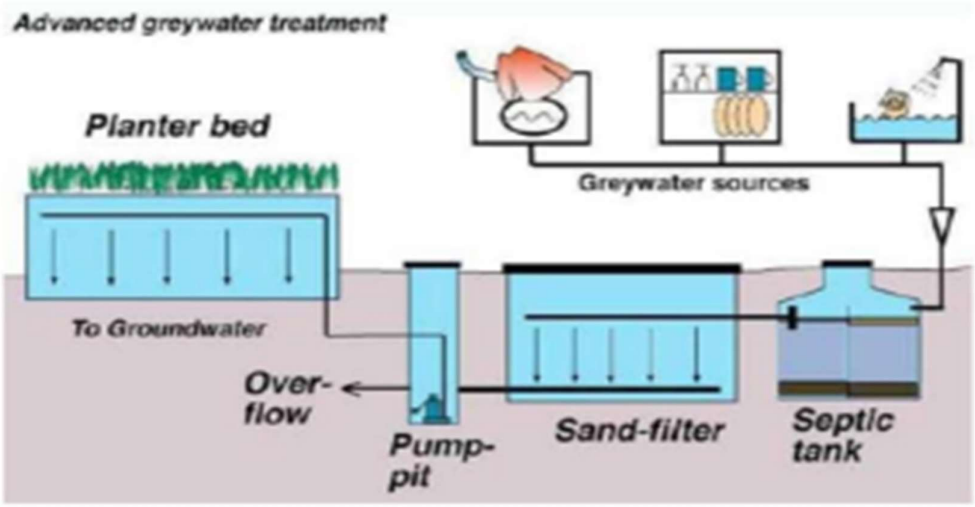

Fig.4. Conceptual Drawing Of water system in green building.

Natural Building

One-half of the world's population lives or works in buildings constructed of earth. Straw bale construction is now gaining in popularity and Many jurisdictions in California have adopted the Strawbale Building Code. Green Building Design favors natural building for its local availability, ease of use, lack of toxic ingredients, increased energy efficiency, and aesthetic appeal.

Passive Solar Design

Passive solar design refers to the use of the sun's energy for the heating and cooling of living spaces. The building itself or some element of it takes advantage of natural energy characteristics in its materials to absorb and radiate the heat created by exposure to the sun. Passive systems are simple, have few moving parts and no mechanical systems, require minimal maintenance and can decrease, or even eliminate, heating and cooling costs.

Solar passive features

A. Shape and form of buildings.
B. Orientation of the facades.
C. Design of Building plan and section.
D. Thermal insulation and thermal storage of roof.

E. Thermal Insulation and thermal storage of the exterior walls. (Fig .5)

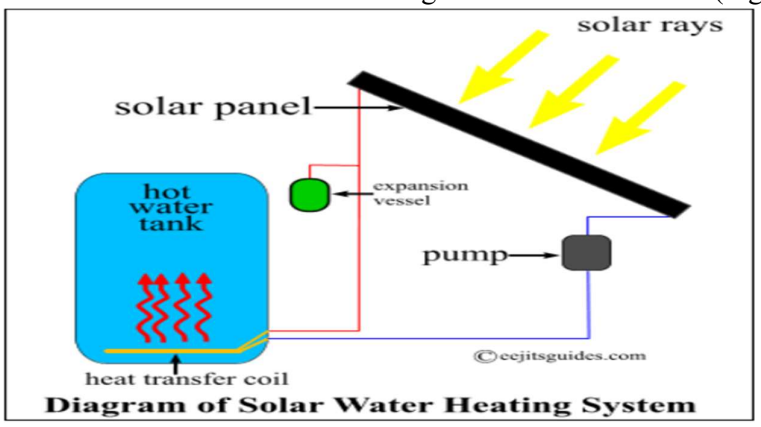

Fig.5. solar water heating system.

Solar buildings are designed to keep environment comfortable in all seasons without much expenditure on electricity 30 to 40% savings with additional 5 to 10% cost towards passive features. Major Components: Orientation, double glazed windows, window overhangs, thermal storage walls/ roof, roof painting, Ventilation, evaporation, day lighting, construction material etc. Designs depend on direction & intensity of Sun & wind, ambient temp., humidity etc. Different designs for different climatic zones

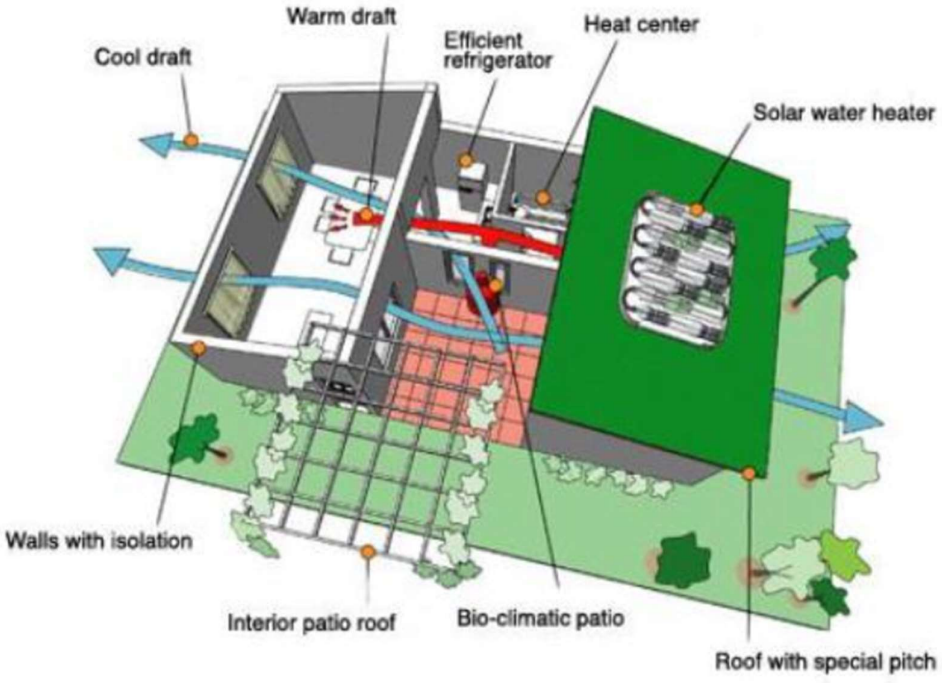

Fig .6. Solar passive features.

Green Building Materials

Before choosing building materials we can find out where the materials come from, how they have been harvested, what the ingredients are, whether they are salvaged, reused or refurbished.

We can research how they will perform over their lifetime of the building.

Living Architecture

We take for granted that our environment - like our bodies - can metabolize nutrients and waste. Living Architecture focuses on these processes, integrating ecological functions into our buildings to catch, store, and filter water, purify air, and process other nutrients. Living Architecture also address esbiophilia, the documented health benefits associated with being in touch with living systems in our built environment.

Elements of green building:

- Solar Water Heating Systems and use of glass panels to allow natural light inside the building during daytime
- Rainwater Harvesting
- Environmentally friendly building materials and specifications.
- Waste minimization ensuring healthy indoor environment
- Maximizing energy use in buildings
- Water Conservation and efficient measures
- Energy efficient equipment.

Advantages of green buildings:

- Environmental advantages:
- Reduced operational energy
- Reduced water requirement
- Lesser volume of waste water generation
- Resulting in lesser water pollution
- Less material usage
- Longer building life
- Lower maintenance cost
- Health and safety advantages:
- Enhance occupant comfort and health
- Community advantages:
- Minimize strain on local infrastructures and improve quality of life Economic advantages:
- Integrated design allows high benefit at low cost by achieving synergies between disciplines and between technologies
- Reduce operating costs
- Lower utility costs significantly
- Optimize life-cycle economic performance

- Productivity advantages:
- Improve occupant performance
- Estimated $29 –168 billion in national productivity losses per year · Providing a healthy workplace improves employee satisfaction Increase retail sales with day lighting

Green Architecture and sustainability management:

Applying sustainability management to buildings requires work under three main headings: construction, lifetime use and decommissioning. Throughout these stages, the three-fold objective is to be efficient in the use of resources, protective of the occupants' health and well-being, and reducing the negative impacts, such as waste and pollution.

There are a number of standards, methodologies and tools that have been put in place to assist organizations in delivering excellent environmental performance with regard to their building stock. There are alternative offerings such as Leadership in Energy and Environmental Design (LEED), Green Globes, Green Building (Europe), BREEAM, the International Green Construction Code, the German Sustainable Building Council, the Green Building Council of Australia, Estidama from the UAE, and CASBEE from Japan. Apart from design and construction, best practices are also discussed with regard to buildings operation and maintenance, and improvements. Sustainable building refers to both the structure and a process that is more environmentally responsible during the entire life cycle of a building. These life cycle stages are:

1. site selection;
2. design;
3. construction;
4. operation and maintenance;
5. renovation;
6. demolition

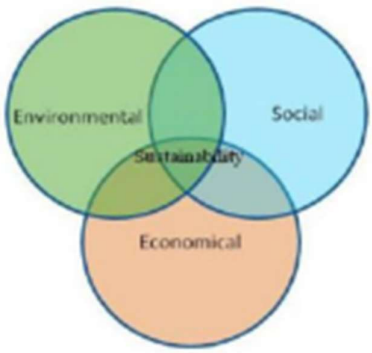

Fig .9. Elements of sustainability

Looking at it more broadly, it could possibly be combined under three main headings:

- Construction – site selection, design, construction
- Lifetime use – operation and maintenance
- Decommissioning – renovation and demolition.

New building technologies, and in particular ICT automation and new materials, are constantly being introduced to enhance the sustainable building process with the goal of reducing the impact of the building on the surrounding environment by: using resources more efficiently (e.g. energy, water); enhancing and protecting the health and well-being of the occupants; reducing negative impacts (e.g. waste, sewage, pollution).

Overview of LEEDP:

Sustainable buildings optimize one or all of these objectives during all phases of the life cycle.

Sustainable or "green" building codes and assessment schemes have been developed on a global basis to give guidance on the factors to review during a building's life cycle that enhance sustainability and minimize environmental impact.

As an example, the Leadership in Energy and Environmental Design (LEED) standards have seen great adoption within the North American market in particular. LEED standards are guidelines to designing, building and operating more environmentally friendly buildings. (Fig .10)

Fig .10. Process of LEED system and its inputs

A final step in almost all sustainable or "green" building codes and schemes is an independent assessment to determine whether a building has met the requirements of a scheme and a final ranking that demonstrates how sustainable a building has been built or is being operated. (Fig .11)

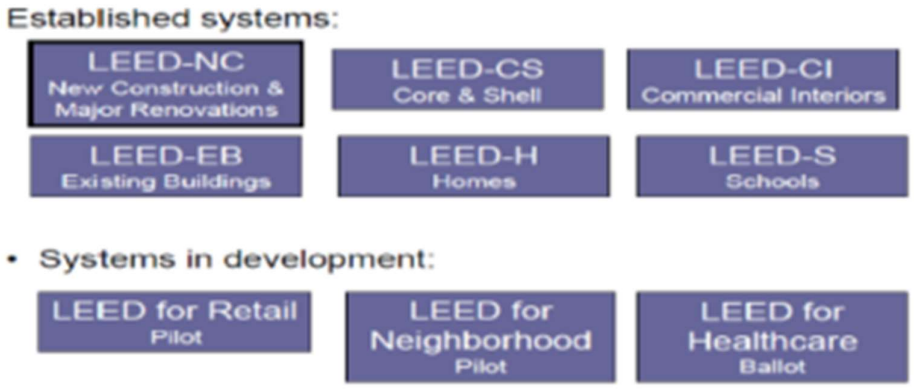

Fig .11. Exiting System of and Developer Systems of LEED

Using LEED as an example, a building can be rated as Platinum, Gold, Silver or Certified after an assessment.

Four levels of certification:

1. LEED Certified 26-32 points
2. Silver Level 33-38 points
3. Gold Level 39-51 points
4. Platinum Level 52-69 points

There is no Bronze level

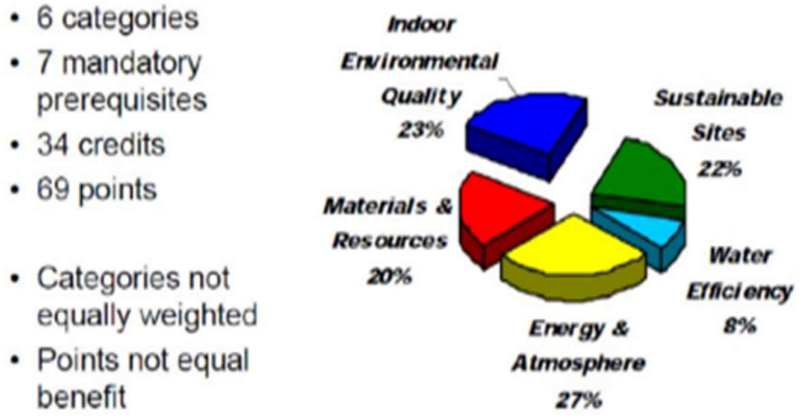

Fig.12. Items of LEED –NC structure

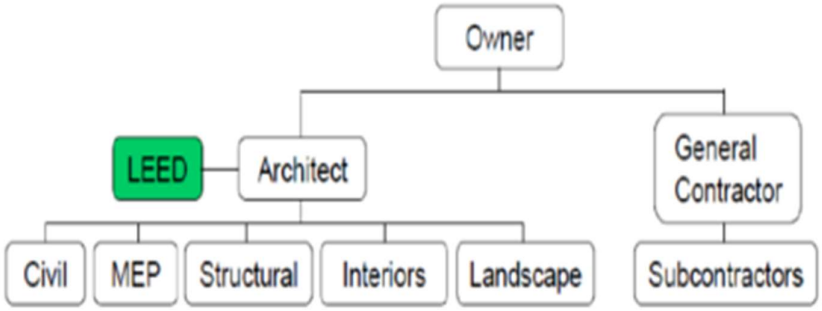

Fig .13. The relationship between LEED and design process

Fig (13) explain that:

- LEED needs to be integrated into the design process
- Requires buy – in from entire team
- Can be accomplished with any delivery method
- There are many business benefits for deciding to pursue a strategy and process for sustainable buildings.

These benefits can be:

- lower operating costs;
- higher return on investment;
- greater tenant attraction;
- enhanced marketability;
- productivity benefits;
- reduced liability and risk,
- a healthier place to live and work;
- demonstration of a commitment to corporate social responsibility; • future proofed assets;

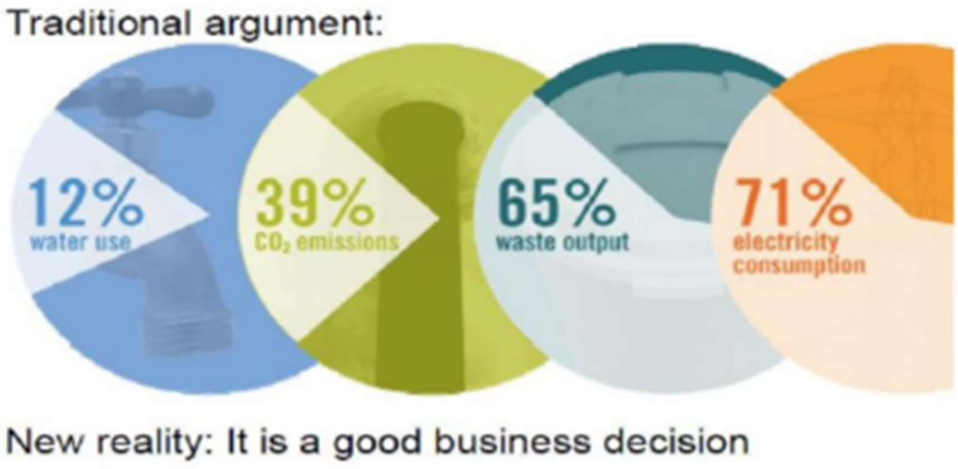

Fig .14. Uses, consumptions and outputs of building

The Concept of Office Buildings:

Office building is a building which indicated the extent of the progress of society and the office building is an integral unit with him. Relies site office buildings on the purpose and quality that will be used by this building, there are several types of office buildings, including buildings, professional (private) as offices of lawyers, and engineers .. etc., and this kind of office must be located on the main artery of transportation, nor mind being a bit far from the city center.

The second type of offices: Is the offices of public services, which occupies the center of the city to the great importance which must be located on the major artery of the movement, as it should be these buildings close to the parking lot, whether on the ground or in multi-storey buildings even reduce the Earth's land surface untapped which are expensive in these locations.

The types of offices that must be close to the city center: corporate offices, government agencies, banks, banks and the stock exchange building and also has offices Agencies and brokers' offices and judicial services. The last type of office is: management offices, factories, and offices that are located near factories that are found on the outskirts of Cities.

Module in The Offices

When designing office buildings must rely on the model of the projected horizontal and in the interfaces and sectors, where chooses module that gives the best solution for the building, which put the interior design on the basis of, and stop this module on an area of the room, which can determine the number of working out and also the type of work they are doing , also pulls dimensions so that they can rely on natural lighting in office lighting to a large extent, and that it can identify bodies appropriate for each of the purposes for which they are placed, intended design Modula try to split the total to parts of the modular design smaller called standard elements or modules, which can be easily changed to be used.

The achievement of modification and adjustments in accordance with the demand and the need for the characteristics by Chapter / functional division) to modules (standard elements graded and non-interconnected detachable and reusable, consisting of the elements of an independent and separate-function self-sufficient. This fully corresponds with the function of the office Module where they can be modified components of the work surface and chair and storage areas in terms of height or dilation or distribution.

Standards and design principles in office buildings

There are important criteria for the design of office buildings must be considered: site office building general outline of the city.

Type projected horizontal (closed, open) and depending on the nature of the building - number of employees in various departments in the building as well as the number of users of the

building from the public considering the presence of shops in the building, whether separate or grouped centers.

The presence of a private garage of the building so that it can use to him based on the undecided technical equipment for the building and how to manage and maintain. -the existence of the movement battery suitable for human energy used for building. - different services in the building (toilets, Office) consideration of safety in the building and that there are escape ladders to be used in case of emergency.

Functional elements in the office building:

Office Offices: office offices are divided in terms of the projected horizontal to two) Muscat horizontal closed, open).

Battery movement: the stairs, elevators, horizontal and roads account for about 30% of the area of the building.

Services and rooms technical equipment: including toilets and control rooms, maintenance and represent in the range of 10% of the total area.

Shop business: You may be in the form of separate or grouped as centers of business and each has its own design.

Garage building: It may be in the street-level, separately or in the role of the building (the role of the basement or loft) and represent an area of mostly about 80% of the area of the building is calculated based on the average users of the building. Reception: be at the entrance of the main building with a relatively large surface area ranging from 30 m2 up to 80 m2.

Mechanism of energy conservation in the office building:

If energy consumption in the eyes of many is the biggest concern, the rationalization in the consumption of renewable energy is the best solution and the safest in terms include the process of rationalization of energy in buildings to choose the optimal form of energy, and use it in a timely manner, in addition to the rational use of energy available, and more types of energy used so far in the office buildings are solar energy, wind energy and bio-energy.

Study of energy consumption in buildings management

There are two factors should be considered when discussing the topic of energy efficiency in buildings management: any form of energy will be used to service the building.

The most effective ways to use this energy:

The best way to save energy in the building is the design of the building so that to achieve greater benefit from the forces of nature. Any exploitation climatic conditions available without resorting to use mechanical methods and call it (the design negative passive system).

Office building from an environmental perspective

Consuming office buildings enormous energy is made of more types of buildings, damage to the environment, and the beginning of the energy consumed in the construction and during operation and even when it is demolished, in addition to the consumption of high-energy in the use of lifts to transport individuals in the realization of ventilation, lighting and heating and cooling due to the adoption of those buildings lighting and ventilation almost entirely, along with other factors resulting from the vertical direction of the building. And then head to think about how to reduce the large consumption of energy for those buildings and make them environmentally friendly buildings.

Axes of energy consumption in office building

The energy consumption in office buildings in the range of the main axes and branch, include vertical movement to move people and goods, which consume a large amount of energy per day, followed by the energy consumed by appliances and equipment used in buildings, and then come after the energy consumed as a result of the work of lighting, ventilation and other illustrated in the following figure percentages for different energy consumption of the various elements of the office building.

Integrated Approach to reduce energy consumption in buildings management

Depends on the entrance of the proposed study all of the design of the building and the office ways to reduce energy consumption in buildings management. As well as the study of the relationship between architectural form and energy efficiency in the building.

Integrated system design of the Office Buildings

Next figure determines the basic structure for the design of buildings and office systems and sub-architectural, structural, mechanical design, which Mizar aspects of energy consumption in various design systems as a prelude to trying to reduce their energy consumption.

Methods and ways to reduce energy consumption in the office building

Can be divided into two main components, namely work on the rationalization of energy consumption in buildings office operating through some architectural styles and treatments, as well as the exploitation of renewable energy sources on the site of the sun and wind and other renewable sources.

Principles of Green Architecture are: Water Systems - Natural Building-Passive Solar Design-Green Building Materials- Living Architecture. These principles are applied in a sustainable trend to achieve an eco- friend building.

An architect has the ability to change entire building process with the stroke of a pen by specifying a material with low carbon dioxide emissions in its fabrication. Generally, there are green building standards available for almost every type of building on a global basis and these standards are well developed and continuously being updated. These standards cover all phases

of a building's life cycle from design through demolition. They are also available in a number of national standards and codes.

Good sustainability performance is not simply about working in buildings that have been designed to be "green".

Buildings that have been designed with sustainability standards in mind need to be operated and maintained using sustainability standards.

Buildings that were not designed to meet sustainability standards when they were built can also be upgraded to meet sustainability standards that have been put in place for existing buildings.

Question Bank

Short

1. What is the need for vegetable-based cutting fluids?
2. Name different environment-friendly materials used in green buildings
3. Write a sort note on zero waste management?
4. Discuss about Argo waste and industrial waste
5. What are green buildings?
6. What is Carbon neutral?
7. What is Ferro cement?
8. What are benefits of green manufacturing systems?
9. Composition of lime pozzolana cement
10. Advantages of Ferro concrete
11. What do you understand by green manufacturing systems?
12. Explain the role of bamboo and rammed earth in the construction of green buildings.
13. Explain the role of timber and lime pozolana cement in the construction of green buildings.
14. Discuss the benefits of green manufacturing systems
15. Explain the role of hollow blocks and agro materials in the construction of green buildings.
16. Explain the role of ferro-concrete and industrial waste in the construction of green buildings
17. What are the benefits of green manufacturing?
18. Explain about alternate roofing system.

Long

1. List the factors which involve in the selection of environmentally friendly materials in manufacturing.
2. Explain how alternate casting and joining techniques improve efficiency?
3. Explain the role of sustainable methods in the planning of sites for green buildings.
4. What are alternate sources for green buildings? Explain them.
5. Discuss about environment friendly machining.
6. Write the benefits of green manufacturing systems.

7. List the benefits of green manufacturing systems over current systems
8. Discuss the various waste management principles used in green buildings.
9. Discuss about Environmental friendly building materials. What are the advantages in using them?
10. What are the methods implemented to reduce heat gain of the buildings?
11. Explain the significance of solar power in green buildings.
12. Explain are the factors influencing site selection of green building.
13. What are the essential properties of building materials?
14. Explain the need for identifying recyclable materials in manufacturing.
15. Explain how hollow blocks can be an alternate to conventional bricks used in construction?
16. Explain briefly how alternate roofing systems can lead to energy savings?
17. What are the basic mechanical properties considered while selection of environmentally friendly materials?
18. Explain in detail zero waste manufacturing systems.
19. Explain how bamboo and timber can be used as construction materials.
20. Explain how selective paints can reduce heat gain in buildings
21. Explain how agro and industrial waste can be used in green buildings
22. Briefly discuss the concept of energy management in green buildings.
23. Elaborate the green building concept. Give any one example of green building
24. Explain the different roofing systems used in green buildings.
25. Discuss the necessity of understanding the basic concept of green buildings
26. Describe energy management system and its importance.
27. Explain the selection of environment friendly materials in manufacturing.
28. Discuss the features and benefits of green buildings
29. Explain the different sustainable practices used in the planning of green buildings for mass comfort.
30. Explain in detail the sustainable site selection for green buildings.
31. Write short notes on the paints to reduce the heat gain of the buildings.
32. Discuss about effective energy management.
33. Discuss about Environmental friendly building materials.