Internal Assessment Test 1 – Jan. 2018

Solutions

Sub	Alternative Building Materials					Sub Code	15CV653	Branch	CIVIL
Date	14/ 03 / 18	Duration	90 mins	Max Marks	50	Sem/Se	VI-A/B		

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1. (a) Is there any disadvantages for rain water harvesting? If so discuss.

Disadvantages of Harvesting Rainwater

1. Additional Expenditure: Treating rainwater to make it fit for human consumption will see you incurring additional expenses. This would not happen when you use water supplied to you by the local council because it's already treated.

2. Huge Efforts and Resources Required: Constructing a dam or an underground tank is no mean fete. Before you begin harvesting rainwater, you'll have spent a considerable amount of resources. There are other cheap means but then you'll not collect a reasonable amount of water.

3. Dependent On Rainfall: You can't harvest rainwater when it does not rain. This process is therefore solely dependent on the availability of rain which can sometimes be very unreliable. What then happens when the dry spell is prolonged and you don't have an alternative source of water?

4. Limited Storage: Even if it rains for three months straight, you cannot harvest all that water even if you wanted to. This is because there is limited storage to keep the rainwater.

5. Risk of Contamination: If not preserved with care, rainwater can be contaminated. This can cause several health problems especially when the water is used without first being treated. Waterborne diseases are so many and treating them is very costly.

6. Cleaning and Maintenance: The storage facilities have to be occasionally cleaned and maintained. Cleaning an underground water tank is not easy and maintaining a dam is very expensive. This makes the thought of harvesting rainwater unattractive.

7. Dual Cost: You'll incur expenses twice because of paying your normal water bills and installing and maintaining the rainwater harvesting system. This will set you back financially in a way.

8. Roof Tops That Contain Chemicals: Some rooftops contain chemicals and impurities that mix with the rainwater. When consumed, this water can affect human health by causing illnesses and other health conditions.

9. Acidic Rain: Due to pollution, sometimes the rain that falls is acidic. Harvesting this type of rainwater is dangerous because of the chemicals contained. Using acidic rain for irrigation can also cause the death of crops because it erodes the quality of soil and creates conditions that are not conducive for plant germination. When the soil has a high pH, plants do not grow properly.

10. Lack of Water for Wildlife: Wild animals get their drinking water from natural sources such as seasonal streams and rivers. They also use them for cooling in the hot weather. Harvesting rainwater reduces the amount of water that flows into these streams and rivers. This affects the ecosystem because some animals are likely to die due to the harsh conditions.

1.(b) Write the methods for rain water harvesting in rural and urban areas.

Urban Areas:

Roof top rain water/storm runoff harvesting through

(i) Recharge Pit

(ii) Recharge Trench

(iii) Tubewell

(iv) Recharge Well

Rural Areas:

Rain water harvesting through

(i) Gully Plug

(ii) Contour Bund

(iii) Gabion Structure

(iv) Percolation Tank

(v) Check Dam/Cement Plug/Nala Bund

(vi) Recharge Shaft

(vii) Dugwell Recharge

(viii) Ground Water Dams/Subsurface Dyke

2. (a) What is embodied energy and Life cycle energy. Why is study of life cycle energy even more important than just knowing embodied energy?

Embodied Energy

Embodied energy is the energy consumed by all of the processes associated with the production of a building, from the acquisition of natural resources to product delivery, including mining, manufacturing of materials and equipment, transport and administrative functions.

Life Cycle Energy

The energy consumed by the building in its total life- cycle.

The total energy requirement of a building over its lifetime may be considered to have five main components (Farinola, 1999):

- The energy embodied in its initial construction
- The energy needed to operate the building in terms of heating, cooling, ventilation, lighting, power etc
- The energy embodied in the regular maintenance and periodic refurbishment of the building
- The energy required for demolition and disposal of the building
- The energy savings as a result of recycling

Study of life- cycle energy is more important because

Assessment of embodied energy of a building material alone can not determine the buildings environmental properties. For instance, the embodied energy figure for a material will be different for residential construction, because it is usually less complicated than the larger, multi-floor commercial construction . Materials such as concrete and timber have the lowest embodied energy intensities but are consumed in very large quantities; whereas the materials with high energy content such as stainless steel are used in much lesser amounts. Besides steel can be re-used and/or recycled in the building industry. Nevertheless the greatest amount of embodied energy in a building is often in concrete and steel. However using these values alone to determine preferred materials is inappropriate because of the differing lifetimes of materials, differing quantities required to perform the same task, different design requirements and also different reuse, recycle properties.

Further more embodied energy must always be considered in the context of the total energy requirement over the life time of a building. Choice of materials can influence operating energy requirements as well as embodied energy. For example, a high mass material such as concrete, although having a larger embodied energy than timber, has the potential for reducing HVAC energy requirements due to its good heat storing properties. In the case of glass fibre insulation, the energy savings over the building's life can be many times that of its initial energy cost , Studies on alternative building materials reveals embodied energy savings as well as reduction in heating and cooling energy requirements. The relevance and accuracy of including embodied energy in the design process when considering life cycle energy implications, forms an integral part of analyzing the total building energy In choosing between alternative building materials or products on the basis of embodied energy, not only the initial materials should be considered but also the materials consumed over the life of the building during maintenance, repair and replacement Therefore a life cycle assessment tool which includes embodied energy as well as other relevant data should be taken into consideration.

2 (b) What are the six key concepts in LEED based on which certifications are given?

i) Sustainable building sites

ii) Water Efficiency

iii) Energy efficiency/ Atmospheric impact

iv) Sustainable materials selection

v) Indoor environmental quality

vi) Innovation and design.

3. Briefly explain about low cost construction

Construction Technique adopted:

(i) Foundation, (ii) Wall, (iii) Roof and (iv) lintel.

1. Foundation

- The foundation cost comes to about 10 to 15% of the total building
- It is adopted for single or double storey building.
- It is recommended to adopt a foundation depth of 2 ft.(0.6m) for normal soil like gravely soil, red soils etc.

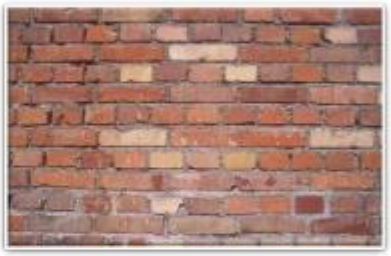
- Suggested to adopt arch foundation in ordinary soil for effecting reduction in construction cost up to 40%.
- In the case black cotton and other soft soils it is recommend to use under ream pile foundation which saves about 20 to 25% in cost over the conventional method of construction.

Arch foundation

- Arch foundations require less digging, material, and being a relatively labor-intensive process, put more laborers to work.

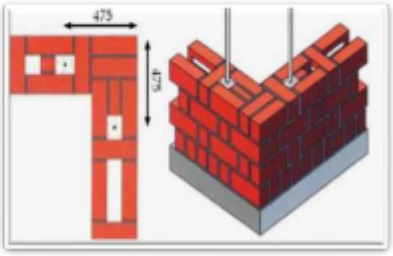
2.Wall

- Wall thickness of 6 to 9" is recommended for adoption in the construction of walls all-round the building and 41/2" for inside walls.
- It is suggested to use burnt bricks which are immersed in water for 24 hours and then shall be used for the walls.
- Making use of **Rat - trap bond wall & Concrete block wall.**



Rat Trap Bond Wall

- It is a cavity wall construction and leads to reduction in the quantity of bricks required for masonry work.
- By adopting this method of bonding of brick masonry compared to traditional English or Flemish bond masonry, it is possible to reduce in the material cost of bricks by 25% and about 10to 15% in the masonry cost.
- By adopting rat-trap bond method one can create aesthetically pleasing wall surface and plastering can be avoided.



Brick jali

- The common burnt brick is one of man's great inventions. all over the world, with only a few exceptions, nearly all bricks are roughly the same shape and size - that is about 9 x 4.5 x 3 inches.
- In many of these situations listed above a "jali" is just as effective.

3.Lintel

- The traditional R.C.C. lintels which are costly can be replaced by brick arches for small spans and save construction cost up to 30 to 40% over the traditional method of construction.
- By adopting arches of different shapes a good architectural pleasing appearance can be given to the external wall surfaces of the brick masonry.

Filler slabs

- They are normal RCCslabs where bottom half (tension) concrete portions are replaced by filler materials such as bricks, tiles, cellular concrete blocks, etc
- These filler materials are so placed as not to compromise structural strength, result in replacing unwanted and nonfunctional tension concrete, thus resulting in economy.
- These are safe, sound and provide aesthetically pleasing pattern ceilings and also need no plaster.

MATERIALS

A)Precast stone blocks of larger size than normal bricks are manufactured by using waste stone pieces of various sizes with lean cement concrete and enable a rationalized use of natural locally available materials.

- **B) Precast concrete blocks** made to similar dimension of stone blocks without large size stone pieces, but using coarse and fine graded cement. They have excellent properties comparable to other masonry blocks, are cheaper and facilitate speedy construction and especially suitable where quality clay for bricks making is not available.

c). Stabilized Mud Blocks (SMB's)

- The excavated soil is mixed in the adequate proportion with the appropriate stabilizer. It is important that the sieved soil be dry/ protected from the rain before being used.

- For stabilized soil cement blocks, the mixture is put into the machine's mold to get pressed.

A block-making machine is used for the creation of stabilized mud blocks. A measured amount of sieved soil, quarry dust, sand/cement or lime is put in the block-making machine mould.

- The blocks are weighed to certify their density and compression, and therefore quality.

•Stabilized earth blocks are designed to take heavy loads, replacing the widely used reinforced concrete columns. It can be used for roofs and walls alike.

4. What are the environmental issues concerned with the construction sector?

Construction causes pollution. The construction business in many countries is responsible for nearly a third of all industry-related pollution incidents. There is no construction which does not have an environmental impact. The main aspect of construction is making buildings of varied uses be it for residential, commercial, industrial, recreation, healthcare or any other purposes.

The estimate of global pollution that can be attributed to buildings is air pollution 23%, climate change gases 50%, drinking water pollution 40%, landfill waste 50% and ozone depletion 50%.(Ref.5)

The major impacts of construction are excessive energy use, global warming and climate change. Energy is consumed when extracting raw materials, producing materials (manufacturing process), transporting materials, transporting workforce, building structures, using and powering structures, maintaining structures and demolishing. In addition, energy is also required for the operation of any structure(s).

In construction, choice and selection of appropriate material play a major role. We need to adopt a sustainable approach in choosing and using materials. The environmental and economic benefits of sustainability are inherently linked when considering building materials. This is due to the long-term financial advantages of recycling, using recycled products and sourcing heavy materials locally. Life-Cycle Assessment, Eco-Labeling and Embodied Energy Audits all can help choosing materials and assess the balance between short-term costs and long-term environmental, social and financial benefits.

Resource depletion, waste and recycling are other major impacts of construction. Material extraction of the primary resources causes major environmental impacts through loss of habitat and ecosystem, damage to the landscape, potential subsidence problems, release of methane, transportation of material, Construction and Demolition wastes and its disposal or processing/recycling of waste.

The other major impact is due to pollution generation and presence of hazardous substances in the natural and built environment. Pollution arising from the built environment includes sewage, waste etc., pollution caused during the manufacture of materials and products, pollution and hazards from the handling and use of materials and actual Construction and site related activities. Considerable pressure can be placed on the local road network and neighboring uses by quarrying operations.

5. Write the specifications of roof top rain water harvesting through recharge trench.

Roof Top Rain Water Harvesting through Recharge Trench:

a. Recharge trenches are suitable for buildings having roof area of 200-300 sq m and where permeable strata are available at shallow depths.

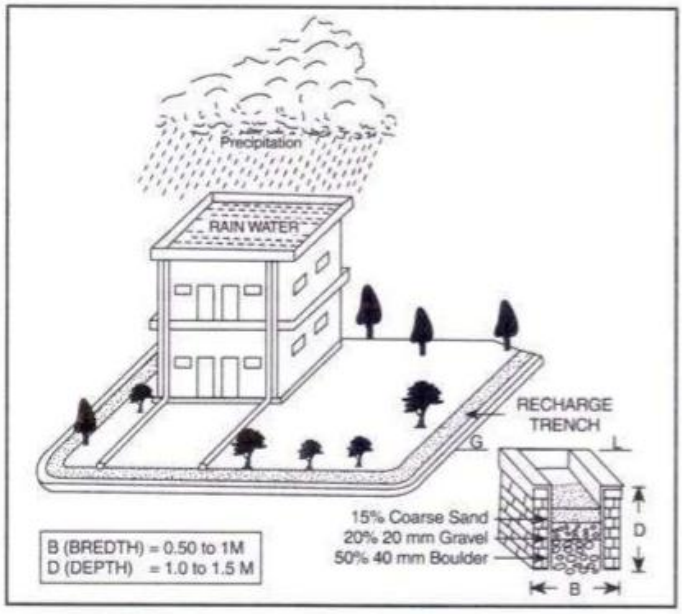
b. Trench may be 0.5 to 1 m wide, 1 to 1.5 m deep and 10 to 20 m long depending upon availability of water to be recharged.

c. These are back filled with boulders (5-20 cm), gravels (5-10 mm) and coarse sand (1.5-2 mm) in graded form—boulders at the bottom, gravel in between and coarse sand at the top so that the silt content that will come with runoff will be deposited on the top of the sand layer and can easily be removed.

d. A mesh should be provided at the roof so that leaves or any other solid waste/debris is prevented from entering the trench and a desilting/collection chamber may also be provided on ground to arrest the flow of finer particles to the trench.

e. By-pass arrangement is provided before the collection chamber to reject the first showers.

f. The top layer of sand should be cleaned periodically to maintain the recharge rate.



Roof top rain water harvesting through recharge trench

6. What are the advantages of green building?

A green building has lower resource consumption as compared to conventional buildings. The following is the percentage reduction of various resources in a building and their respective reasons.

- Green buildings consume 40% to 60% (depending on the range of measures adopted) lesser electricity as compared to conventional buildings. This is primarily because they rely on passive architectural interventions in the building design, and high efficiency materials and technologies in the engineering design of the building.
- Green Buildings also attempt to work towards on-site energy generation through renewable energy utilization to cater to its energy needs. For instance, solar thermal systems can help generate hot-water and replace the conventional electrical geyser in buildings. Solar PV panels can help generate electricity which can reduce the buildings dependence on grid power.
- Green buildings consume 40% to 80% (depending on the range of measures adopted) lesser water as compared to conventional buildings. By utilizing ultra low-flow fixtures, dual plumbing systems, waste-water recycling systems and rain-water harvesting, green buildings not only reduce their demand for water use but also look at on-site supply options to cater to its internal and external (landscape) water demands.
- Green buildings generate lesser waste by employing waste management strategies on site. They may also employ waste to energy or waste to resource (like manure, or compost) strategies on site, to minimize their burden on municipal waste management facilities and land fills.
- Green buildings generate lesser pollution both during construction as well as while in use. Through best-practices such as proper storage of construction materials, barricading of the site to prevent air and noise pollution during construction, proper storage and disposal of waste during construction and operation, and so on, ensures reduced impact on the surrounding environment.
- Green buildings ensure proper safety, health and sanitation facilities for the labourers (during construction) and the occupants (while in use).
- Green buildings restrict the use of high ODP (ozone depleting potential) substances in their systems as well as in finishes.
- Green buildings offer higher image and marketability.

All of these can be achieved at a minimal incremental cost with an estimated payback period of about 3–5 years (excepting renewable energy for power generation).