PART A

Answer all questions, each set carries 5 marks.

1. a1) Give an example of any activity where sustainability and technology go hand in hand. (2)
   a2) Write a short note on multilateral agreements with examples. (3)

   OR

2. a1) Distinguish between carbon credits and carbon trading. (3)
   a2) List out any two methods by which carbon footprint can be reduced. (2)

   OR

b) How would you take initiatives in conducting your college fest, so that it remains an environmentally sustainable one? (5)

3. a1) Discuss the benefits of doing an EIA study. (2)
   a2) List down any six impacts considered in EIA. (3)

   OR

b1) Write a short note on EMS. (2)
   b2) Briefly indicate the steps involved in introducing EMS in an industry. (3)

4. a) Introduction of metro service in Kochi is a major achievement for the transportation system of the city. Do you think this can be related to sustainable engineering? If so, explain. (5)

   OR

b) Write a short note on how appropriate material selection can contribute in achieving sustainability in building construction. (5)

5. a) Suggest few measures by which usage of energy can be reduced in residential buildings. (5)

   OR

b) List the different types of renewable energy sources. (5)

6. a) Explain hybrid power systems with examples. (5)

   OR

b) Discuss the advantages and disadvantages of nuclear energy. (5)

7. a) With a suitable example, explain the principles of industrial symbiosis. (5)

   OR

b) How can the industrial sector achieve a sustainable growth through the concept of industrial ecology? (5)

8. a) Discuss any three benefits of green engineering. (5)
b) List down the tools that can be used for pollution reduction in industries. (5)

Explain in detail any two of them.

PART B

(Read the Stories/Cases/Data set as the case may be, and answer all questions, each full question carries 10 marks.)

Environmental ethics considers the ethical relationship between people and the natural world and the kind of decisions people have to make about the environment. Most people recognise that our planet is in a bad way and we all seem to have an opinion on environmental issues, such as climate change or the use of four wheel drive cars in cities. There has been a rapid growth in knowledge and technology, so that humans now face choices we have never had to face before that affect the continuation of humanity and the world within which we live. Environmental ethics simply tries to answer the questions of how humans should relate to their environment, how we should use the earth’s resources and how we should treat other species, both plant and animal.

Module I

9 a) How is people and nature related to each other? (4)
b) “Most people recognise that our planet is in a bad way…” . Give examples of any two problems that are present now, but not existed in the past. (3)
c) Explain the significance of sustainable development with respect to the above passage (3)

Stories/Cases/Data set - 2

Table 1 Annual average (2015) PM$_{10}$ levels in different cities of India ($\mu$g/m$^3$)

<table>
<thead>
<tr>
<th>No</th>
<th>City</th>
<th>State</th>
<th>Annual average</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Delhi</td>
<td>Delhi</td>
<td>268</td>
</tr>
<tr>
<td>2</td>
<td>Faridabad</td>
<td>Haryana</td>
<td>240</td>
</tr>
<tr>
<td>3</td>
<td>Kanpur</td>
<td>Uttar Pradesh</td>
<td>201</td>
</tr>
<tr>
<td>4</td>
<td>Patna</td>
<td>Bihar</td>
<td>200</td>
</tr>
<tr>
<td>5</td>
<td>Agra</td>
<td>Uttar Pradesh</td>
<td>186</td>
</tr>
<tr>
<td>6</td>
<td>Mumbai</td>
<td>Maharashtra</td>
<td>107</td>
</tr>
<tr>
<td>7</td>
<td>Hyderabad</td>
<td>Telangana</td>
<td>93</td>
</tr>
<tr>
<td>8</td>
<td>Chennai</td>
<td>Tamilnadu</td>
<td>81</td>
</tr>
<tr>
<td>9</td>
<td>Vishakapatnam</td>
<td>Andhra Pradesh</td>
<td>61</td>
</tr>
<tr>
<td>10</td>
<td>Mysore</td>
<td>Karnataka</td>
<td>46</td>
</tr>
</tbody>
</table>

The above table shows the annual average PM$_{10}$ levels in different cities of India for the year 2015. It can be seen that most of the cities are having the pollutant levels higher than the corresponding NAAQS (60 ($\mu$g/m$^3$)).
Module II
10 a) Discuss the health effects on human beings due to particulate pollution (4)
b) Give a short note on the air pollution problems faced by any of the above cities (3)
c) Suggest some preventive measures for reducing air pollution (3)

Stories/Cases/Data set - 3
The tardigrade (water bear) undergoes a process called anhydrobiosis: it can remove all water from its body and live in an arrested metabolic state for 150 yrs. Add a drop of water and it completely reanimates. Biomatrica, a San Diego based company, has figured out how to replicate this process and has applied it to DNA and RNA storage. Samples can be stored on shelves at room temperature. This is a significant energy saver when applied to DNA storage systems. This new technology can significantly reduce the energy and maintenance costs. It also decreases the amount of storage space needed to store DNA/RNA samples. Imagine the energy and money savings if all DNA/RNA storage was switched to this process.

Module III
11 a) Briefly describe the technology mentioned in the above passage (4)
b) Give any other (any two) examples of inventions developed based on this technology (3)
c) Discuss the advantages of this technology (3)

Stories/Cases/Data set - 4
The CESE (Centre for Environmental Sciences and Engineering) building at IIT Kanpur has been awarded five star GRIHA rating by TERI. The CESE is a research facility at the IIT (Indian Institute of Technology), Kanpur on a plot area of 175000 square metre (approximately 4.5 acres). The evaluation committee has awarded a final score of 93 out of 100 to the building. The building has incorporated many green features following the GRIHA recommendations. The building is fully compliant with the ECBC. EPI (Energy Performance Index) of the building is predicted to be 45.43 kWh/m²/annum, which is 41.3% less than the TERI GRIHA benchmark. In comparison to a conventional building, 59% energy savings are predicted in the CESE building. The centre has attempted to conserve and utilize resources efficiently; and recycle, reuse, and recharge the systems at every stage of design and construction.

Module IV
12 a) Suggest few measures that can be adopted for energy efficiency in green buildings. (4)
b) Write a short note on GRIHA rating. (3)
c) Discuss on green material selection with examples. (3)

Stories/Cases/Data set - 5
Country A is a small land locked nation with a predominantly agricultural economy and having a tropical climate (warm dry winters and warm wet summers). At present the nation is self sufficient in food supply and food products are its major export. It has no native fossil fuel resources. It does have a number of rivers which are fast flowing during the wet season but prone to drying up during the dry season. These rivers are vital for irrigation of the agricultural land. Electricity generation presently accounts for 30% of the nation’s primary energy consumption, transport accounts for 40% and the remaining 30% for other uses. In order to reduce dependence on fuel imports and to help comply with international treaties limiting carbon emissions, the
government of country A is considering investing heavily in renewable energy.

**Module V**

13  a) Which are the different forms of energy through which Carbon emissions can be reduced? (4)

b) Based on the information given above write a short report outlining the relative advantages and disadvantages of two forms of renewable energy for the country. (3)

c) Which form of energy is more appropriate for the country, write your recommendation. (3)

**Stories/Cases/Data set - 6**

**URBANIZATION LEVELS AND URBAN GROWTH RATES BY REGION 1970-2020**

![Graph of urbanization levels](image)

Source: WHO (7)

**Module VI**

14  a) Study the above graph (Figure 1) and write a short note on the increasing intensity of urbanisation with respect to the above data. (4)

b) Explain the concept of sustainable urbanisation. (3)

c) Discuss some of the ill effects due to increasing urbanisation based on the above data. (3)

****
PART A

Answer all “a” OR “b” set questions, each set carries 5 marks.

1 a) What are the three levels with which you approach a sustainable issue? Explain with an example.

OR

b) List any five multi lateral environmental agreements.

2 a) Apply 3R concept to mineral water bottles.

OR

b) List and explain any three local and regional environmental issues.

3 a) Can we use life cycle analysis (LCA) as a tool for profit making? How?

OR

b) List any 5 products developed bases on bio mimics.

4 a) List specialities of a green building in your dream and suggest any five green building materials that you will suggest for the same.

OR

b) Suggest any three suitable green transport systems for your travel from place of stay to college.

5 a) Suggest two renewable energy sources for our state and validate your suggestion.

OR

b) What are the energy saving opportunities in a house?

6 a) Suggest two renewable energy sources that can be utilized in automobiles.

OR

b) Explain different method using which we can utilize solar energy.

7 a) Apply idea of industrial symbiosis to the coconut oil industry

OR

b) Do you prefer an urban area living? Substantiate your answer.

8 a) In your viewpoint, what are reasons of poverty?

OR

b) As an engineer suggest any 5 points to reduce pollution by an industry in your locality.

PART B

(Read the Stories/Cases/Data set as the case may be, and answer all questions, each full question carries 10 marks.)

Module 1

9 a) List social, economic and environmental aspects of a hydro electric power project proposed/implemented in Kerala state.

b) Do you think Indian water act is sufficient to protect the water body that you

Max. Marks: 100
Duration: 3 Hours
selected in the last question?

c) Identify an engineering/social problem in your locality and suggest any sustainable solution.

d) What are the challenges that you will face while you are trying to implement the solution you suggested in the last question?

(2)

**Stories/Cases/Data set - 2**

In metro cities in India, an individual produces an average of 0.8 kg waste/person daily. The total municipal solid waste (MSW) generated in urban India has been estimated at 68.8 million tons per year (TPY) (0.573 million metric tons per day (MMT/d) in the year 2008). The average collection efficiency of MSW ranges from 22% to 60%. MSW typically contains 51% organic waste, 17% recyclables, 11% hazardous and 21% inert waste. However, about 40% of all MSW is not collected at all and hence lies littered in the city/town and finds its way to nearby drains and water bodies, causing choking as well as pollution of surface water. Unsegregated waste collection and transportation leads to dumping in the open, which generates leachate and gaseous emissions besides causing nuisance in the surrounding environment. Leachate contaminates the groundwater as well as surface water in the vicinity and gaseous emissions contribute to global warming.

**Module II**

10 a) Do you think local environmental issues contribute to global warming? (2)

b) Suggest any three solutions to the issues, mentioned in the above data. (4)

c) List any three global impacts of issues mentioned in above information. (2)

d) Do you prefer 3R concept or zero waste concept to address above issue? (2)

**Module III**

11 a) Conduct a sample life cycle analysis of any product given below (10)

Plastic pet bottles, lead acid batteries or hollow bricks.

**Module IV**

12 a) Prepare schematic representation of a residential building with minimum ten aspects that are applicable to green buildings. (10)

**Stories/Cases/Data set - 5**

Module V

13 a) Comment about the utilization of renewable energy sources in India based on the above data. (3)
b) What are the challenges that we face to develop renewable sources in India? (3)

a) List the different sources that continues to the item renewable in the above data (2)

**Stories/Cases/Data set - 6**

(Stories/Cases/Data set)

**Industrial Ecology In Practice**

**Kalundborg, Denmark**

The exchange of 'wastes' between independent firms in some sectors has been taking place for over a century, simply because it makes good business sense. The establishment of 'industrial ecosystems,' however, is a relatively new phenomenon, with the best known example being located in Kalundborg, Denmark. There, an industrial ecosystem has been established which involves an oil refinery, a gyproc factory, a pharmaceutical firm, a fish farm, a coal-fired electrical power station and the municipality of Kalundborg, among others. At Kalundborg, steam and various raw materials such as sulfur, fly ash and sludge are exchanged in what is the world's most elaborate industrial ecosystem. Participating firms each benefit economically from reduce costs for waste disposal, improved efficiencies of resource use and improved environmental performance. For example, gas captured from the oil refinery which had previously been flared off is now sent to the electrical power station which expects to save the equivalent of 30,000 tons of coal a year.

**Module VI**

14  a) Based on above story explain your ideas about industrial ecology. 2

   b) Can we implement industrial ecology in India? Substantiate your answer. 2

   c) Differentiate industrial ecology and industrial symbiosis with examples. 2

   d) List four set of industries were we can implement industrial symbiosis. 4

   ****
PART A

Answer all questions; each carries 5 marks

1. (a) Technology can be treated as a double-sided coin. Comment on this statement with reference to agriculture.

OR

(b) Suppose the water in the well near your house tastes bad as well as has a foul odour. You realize that there is a factory nearby and the wastewater percolates through the ground and contaminates the ground water. What would you suggest to do about this problem to your family and the neighbours? To what authority would you complain this? Describe about the authority concerned and the related environmental law/act.

2. (a) (i) What do you mean by Carbon Footprint? (1)

Read the following passage and answer the question given below it:
Kerala government has put curbs on traders procuring vegetables from Tamil Nadu after they found that pesticide levels in the vegetables were higher than permissible. Kerala food safety department has written to Tamil Nadu's agriculture and food safety department stating: "pesticides were being used excessively in vegetables produced in Tamil Nadu and sent to Kerala". One reason for such high levels is because harvested vegetables are dipped into pesticide concoctions to ensure they are not eaten away by pests during transport across states, in the report by the food safety department. This defies all guidelines, and shopkeepers complain of dwindling business.

(ii) Mention and explain a single solution to the Carbon Footprint arising as a result of transportation of vegetables as well as the pesticide issue. (4)

OR

(b) (i) Explain 3R concept of waste management. (2)
(ii) What do you mean by E-waste? What are the possible sources of E-waste? How can we dispose E-waste without causing harm to the environment? (3)

3. (a) What do you mean by Bio-mimicking? Explain any two examples for bio mimicking.

OR

(b) The LCA of iPhone 6s is given in Fig.1. Write the Environmental impacts of steps 1 to 5.

![Fig. 1](image)

4. (a) List out any five methods for increasing energy efficiency in Buildings.

OR

(b) (i) Green buildings cost more than traditional buildings. Do you agree with this statement or not? Justify your answer? (3)

(ii) Your neighbor plans to construct a new house. Suggest some green materials for the building. (2)

5. (a) Explain a typical wind energy system with block diagram. (5)

OR

(b) (i) What is bio energy? (1)

(ii) Explain briefly any four methods for converting biomass to energy. (4)

6. (a) Iceland is a volcanically active place. Suggest a potential form of non-conventional energy to adopt. Explain in detail.
OR
(b) Neha thinks that India can become a developed country only if it uses more and more energy. George thinks Neha is wrong. Who is right? Why?
7. (a) Suggest some measures to be taken for moving Kerala towards the goal of sustainable poverty reduction.

OR
(b) (i) Sketch and label the pollution prevention hierarchy triangle (2)
(ii) “It is better to prevent waste than to treat the waste or clean up after it is formed.” – Comment. (3)
8. (a) Two industries – Industry A and Industry B - emit same amount of CO₂. Industry A uses a filter to purify the smoke emitting from the chimney. But Industry B plant more trees near the Industry. Which is more sustainable? Why?

OR
(b) Studies show that the total Urban population is expected to rise to 5 billion by the year 2030. What do you think is the reason behind this? How does this affect the sustainability?

PART B
(Read the stories/cases/data set as the case may be and answer ALL questions. Each FULL question carries 10 marks)
Module 1
KGS Aranmula International Airport was an airport project planned to be built at Aranmula, Kerala in India, at a cost of Rs. 20 billion. The controversial project faces strong protest from environmentalists and local people as well as the opposition parties in Kerala. The project was expected to generate 1,500 direct and 6,000 indirect jobs. Of the 500 acres earmarked for the project, 400 acres were paddy field. The runway for the airport is being constructed over the Kozhithode canal, a tributary of the Pamba. Many hills in the neighbourhood will have to be razed for soil to reclaim the fields, a process that could lead to biodiversity loss and water shortage.
9. (a) What are the three basic pillars of sustainability? Explain. (5)
(b) How would have the KGS Aranmula International Airport project affected the three pillars of sustainability if it was implemented? Discuss. (5)
Module 2

10. (a) Write a short note on Ozone layer depletion (2)
(b) Distinguish between greenhouse effect, global warming, and climate change. (3)

A surreal sight greeted residents and commuters at VarthurKodi junction in east Bengaluru on one fine morning – fluffy piles of foam covered the road. From a distance, it looked like the road was covered with snow. But the innocuous-looking foam hid a darker truth – it was toxic foam frothing from an outlet of the nearby Varthur Lake.

Varthur Lake is at the tail end of a network of lakes in the city and sewage that flows into Koramangala or Challaghatta lakes from Puttenahalli in southern Bengaluru and from RT Nagar in north Bengaluru eventually ends up in it. Varthur collects the maximum amount of sewage water, most of it untreated. High levels of Ecoli bacteria found in untreated sewage percolate through the ground to the groundwater table and cause waterborne diseases.

The foam is a result of the water in the lake having high content of ammonia and phosphate and very low dissolved oxygen. Sewage from many parts of the city is released into the lake, leaving it extremely polluted. The foam spilled onto Varthur Main Road, causing a traffic pile up on Tuesday morning. An unbearable stench hung in the air for a 5km stretch around Whitefield.

(c) From the paragraph above, explain briefly what are the possible reasons for the formation of foams and its encroachment on the road? (2)
(d) Suggest and explain a possible method of sustainable water treatment method to tackle this situation. (3)

Module 3

11. (a) Match Set A with Set B.

Set A: ISO 14001, ISO 14040, ISO 14011, ISO 14023
Set B: Environmental Labeling, Life cycle Assessment, Environmental Management System, Environment Auditing

(b) Explain in detail the procedure of EIA in India. (8)

Module 4

Development of road infrastructure has not kept pace with the rapid increase in the number of vehicles in Kerala. The number of all class vehicles in the State went up from 1.19 lakhs in 1975 to 36 lakhs in 2006. This was accompanied by increase in road length from 14,870 km to 21,347 km. This shows that like other cities in the country, the cities of Kerala too have responded to
transportation shortfalls by expanding the road network. Although development of road network is important, roads comprise only one component of the entire transport system.

Energy intensity of various transport modes is a key factor in determining transport related environmental impacts. Energy consumption per passenger km by bus is the least and is highest for cars among road based personalised vehicles. On an average, a car consumes six times more energy than a bus, while two-wheelers consume 2.5 times and three-wheelers 4.7 times more energy. In terms of fuel cost per passenger km, a three-wheeler is about six to seven times costlier than a bus and two-wheeler is at least twice costlier than the bus.

Although the traffic density on the roads has increased manifold over the years, the improvements in transportation network have not kept pace with the growth of population and motor vehicles. Transportation problems, experts say need to be tackled in a coordinated, multi-nodal system of road, rail and water transport and also using the latest trends in engineering.

Some initiatives have been taken up by the Government to improve the public transport system and to discourage the entry of private vehicles.

12. (a) Explain the concept of Sustainable Transport System. (3)
(b) Referring to the above information, list out the impacts of existing transportation system on the three basic pillars of sustainability. (3)
(c) Infer the paragraphs above and list out the importance and methods for implementing sustainable transportation in Kerala. (4)

Module 5

Arya: Aneesh, the article in this magazine says that our coal reservoirs are enough to meet the growing energy demands of present generation. I wonder, then why all are talking too much about alternative energy sources.

Aneesh: Its because it is our responsibility to keep the available resources for our future generations too.

13. (a) Give your comment on this conversation. (2)
(b) List out the advantages of using renewable energy sources. (3)
(c) Discuss on the contribution of coal power to Kerala’s energy production. (2)
(d) How can you make use of renewable sources of energy at your home? (3)
Module 6

14. (a) Refer to Fig. 2 given below. What does the figure represent? Explain briefly about the concept. What are its benefits? 

(b) What do you mean by Industrial Ecology? Write down the principles and benefits of Industrial Ecology?
PART A
Answer all “a” OR “b” set questions; each set question carries 5 marks

1) (a) (i) Explain the three pillar model of sustainability. (3)
(ii) List four strategies for achieving Sustainable development. (2)
OR
(b) (i) Illustrate the nexus between agricultural technology and sustainability. (3)
(ii) What is the relevance of Kyoto Protocol? (2)

2) (a) (i) Suggest any two sustainable methods for waste water treatment. (2)
(ii) Explain the phenomenon of Ozone layer depletion. (3)
OR
(b) Explain the significance of carbon footprint. Suggest two methods for reducing the carbon footprint in your house. (5)

3) (a) (i) EMS framework follows a Plan-Do-Check-Act (PDCA) cycle. Explain. (3)
(ii) What do you mean by Bio-mimicking? Support your answer with one example. (2)
OR
(b) List out various procedures of EIA in India (5)

4) (a) (i) List any four sustainable building materials. (2)
(ii) Explain three methods for increasing energy efficiency of buildings. (3)
OR
(b) Suggest five strategies for achieving sustainable transport and explain. (5)

5) (a) Explain a solar water heating system with the help of a diagram. (5)
OR
(b) Explain the working of a Photovoltaic cell with a neat diagram (5)

6) (a) What are the steps involved in bio-fuel production? (5)
OR
(b) Explain any one method to extract Geothermal energy. (5)

7) (a) Illustrate the push factors and pull factors which leads to the migration of people from rural areas to urban areas. (5)
OR
(b) Explain five major benefits that an industry can expect from the adoption of eco-friendly industrial practice. (5)

8) (a) Illustrate five practices for making the industrial process move towards the goal of sustainability. (5)
OR
(b) Explain Industrial Symbiosis? (5)
PART B
(Read the Stories/Cases/Data set as the case may be, and answer ALL questions. Each FULL question carries 10 Marks.)

Case 1
Kumarakom, a backwater tourism hub in Kerala is gaining importance in the tourist map due to its natural charm and aesthetic beauty. Kumarakom is situated in the banks of Vembanad Kayal (backwater); 10 km. west of the Kottayam District Head Quarters in Kerala. The arrival of tourism industry was well received by the local people initially with the land value increasing many folds in the potential areas for tourism ventures. Local farmers offered their agricultural lands and paddy fields for tourism construction at exorbitant prices. The temporary employment opportunities in the construction sector and relatively higher wages earned, made the local workers happy. But all was not well in the years to come. The clustering of the resorts on the banks of Vembanad Kayal denied access to local people involved in fishing and shell collection to the kayal. The irony is that tourism has contributed nothing in improving the infrastructure development or the development of service and productive sectors in Kumarakom. The employment opportunity in the tourism sector was not favourable to the local community with 80% of the regular employees in big hotels appointed from outside Kumarakom. Women and agricultural labourers displaced from the lands converted for tourism could not be compensated with alternative jobs. The contract labourers appointed by the tourism industry did not have job security and were terminated at any time without assigning any reason. Although these workers are eligible for minimum wages, they are paid at much lower rates.

Module 1
Q 9
a) List any three major challenges for attaining environmental sustainability in Kumarakom. (3)
b) Illustrate the need for sustainability in tourism sector. (4)
c) Suggest three ways to mitigate the adverse impacts created by tourism on the ecology of Kumarakom. (3)

Case 2.
Air pollution is responsible for many health problems in the urban areas. The air pollution status in Kerala has undergone many changes in terms of the levels of pollutants and the control measures taken to reduce them. Air pollution in the state is mainly due to Industrial and vehicular emissions. The transport sector in urban areas has created major problems of air pollution due to the rapid growth in the number of motor vehicles. Number of registered vehicles has increased considerably in the state for last ten years. The vehicle density in the state is very high compared to many other states in India. Kerala has 5958 vehicles per 100 sq. km. of area and 7272 of vehicles per lakh population. The number of vehicles is increasing at a rate of 10 percent annum, leading to concurrent increase in serious air pollution. Recently National Green Tribunal banned light and heavy diesel vehicles which are more than 10 years old in six municipal corporations in Kerala. The order also prevented the state government from registering new diesel vehicles of 2000 cc and above. Later Kerala High Court stayed above mentioned NGT orders on diesel vehicles.
Module 2

Q 10

a) List any two harmful effects of air pollution on human health. (2)
b) List any two possible impacts of diesel vehicles during the usage stage. (2)
c) Suggest two methods to reduce the adverse impacts of diesel vehicle during utilisation. (2)
d) There is a sudden decision to remove all vehicles from the road that fails to meet specified norms within a specified time period. As part of citizen forum you are requested to give views on the enforced regulation. State your views on this and justify your answer with not less than two points. (4)

Module 3

Q 11 Write the LCA of shoes made of Leather. (10)

Case 3

Green buildings represent the response of the building sector to the need to minimize negative environmental, social, and economical impacts in the building sector. Through using green building practices, it is possible to work toward the aim of meeting the needs and aspirations of today without compromising the ability of future generations to meet their own needs. To achieve a green building, green design and construction strategies should be incorporated at the planning stage to the demolition phase of the building. A green building relies upon a fully integrated “whole building” approach that covers the entire phase of building cycle including design, construction, operation, and demolition. Multiple studies have demonstrated how green buildings that incorporate green building practices offer benefits. For example, they can help mitigate building issues and problems, including environmental problems associated with existing buildings, and also provide healthier indoor environments to building users.

Module 4

Q 12

a) How a green building differs from a conventional building. Compare in any five aspects. (5)
b) Explain any three criteria for material selection for sustainable design of buildings. (3)
c) List any two green building certifications systems in India. (2)

Case 4

The development of infrastructure is an important factor to sustain economic growth. The power sector is one of the most important constituents of infrastructure. The achievement of energy security necessitates diversification of our energy resources and the sources of their supply, as well as measures for conservation of energy. So far, we were dependent on conventional sources of energy like thermal, hydro (large hydro) and nuclear. The impact of the energy crisis is particularly felt in developing countries like India, where an ever-increasing percentage of national budgets earmarked for development must be diverted to the purchase of petroleum products. After independence large hydroelectric projects have been executed, some of them are still under construction and some have been planned for future. For nuclear power plants also there is a problem of getting proper fuel, processing and safety from radiations. In addition, global warming caused largely by greenhouse gas emission from fossil fuel generating systems is
also a major concern. To overcome the problems associated with conventional sources of energy, most countries including India have shifted their focus to develop non-conventional sources of energy. With the various initiatives taken by the government, a healthy power sector would emerge in the country which would pave the way for fast industrialisation, growth in agricultural production, rural development and a better quality of life through non-conventional energy sources.

Module 5

Q 13

a) List out four non-conventional sources of energy and explain any two in detail (6)
b) Enumerate any two reasons for the challenges faced by India in energy sector. (2)
c) Suggest two ways to create awareness about the importance “Energy Conservation” among public. (2)

Case/ Data 5

India’s top 30 urban centres with the largest populations living in slums

Module 6

Q14

a) Illustrate any four major reasons behind slum formation in India. (4)
b) List any three methods for sustainable poverty reduction. (3)
c) Imagine that a campaign on poverty eradication is to be initiated in a Slum. Frame a slogan for that campaign (3)