



Important Instructions to examiners:

- 1) The answers should be examined by key words and not as word-to-word as given in the model answer scheme.
- 2) The model answer and the answer written by candidate may vary but the examiner may try to assess the understanding level of the candidate.
- 3) The language errors such as grammatical, spelling errors should not be given more importance. (Not applicable for subject English and Communication Skills.)
- 4) While assessing figures, examiner may give credit for principal components indicated in the figure. The figures drawn by the candidate and those in the model answer may vary. The examiner may give credit for any equivalent figure drawn.
- 5) Credits may be given step wise for numerical problems. In some cases, the assumed constant values may vary and there may be some difference in the candidate's answers and the model answer.
- 6) In case of some questions credit may be given by judgment on part of examiner of relevant answer based on candidate's understanding.
- 7) For programming language papers, credit may be given to any other program based on equivalent concept.

Q. No	Sub No	Model answer	Marking Scheme	Total Marks
Q.1		Attempt any <u>FIVE</u> of the following :		10m
	(a) Ans.	List renewable energy resources. 1. Solar energy 2. Wind energy 3. Ocean energy 4. Hydro energy 5. Biomass energy	<i>1/2m each (any four)</i>	
	(b) Ans.	Define air pollution and environmental pollution. Air pollution – It is an atmospheric condition in which certain substance are present in concentration which can cause undesirable effects on humans and environment. OR It is a contamination of air by means of harmful substance which causes adverse effect on human and environment. Environmental pollution – Any undesirable change in the physical, chemical or biological characteristics of any component of environment i.e. air, water and soil which can cause harmful effects on various forms of life or property.	<i>1m each</i>	
	(c) Ans.	State different types of Environmental Audits. Basic types of Environmental Audit – 1. Objective based type – it is based on assessment of any activity, its scope and objectives. So based on objective environmental audit is again classified as – a. liability audit b. management audit c. activities audit 2. Client driven type – it is based on who has commissioned or ordered the audit procedure. So based on client driven environmental audit is again classified as – i. Regulatory external audit ii. Independent external audit iii. Internal environmental audit iv. Third party audit.	<i>2m</i>	

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	<p>(d) Explain the necessity of environmental audits.</p> <p>Ans.</p> <ol style="list-style-type: none"> 1) To serve to achieve compliance standards and establish report with regulatory bodies. 2) To review the implementations of policies. 3) To identify liabilities to review management systems. 4) To identify needs, strengths and weaknesses. 5) To assess environmental performance. 6) To promote environmental awareness. 7) To improve production, safety and health. 8) To conserve natural resources. 9) To reduce waste. 10) To assess compliance with the regulatory requirements 11) To pace environmental information to public. <hr/> <p>(e) Define LEED criteria.</p> <p>Ans. Leadership in Energy and Environmental Design (LEED) is one of the most popular green building certification programs used worldwide. Developed by the non-profit U.S. Green Building Council (USGBC) it includes a set of rating systems for the design, construction, operation, and maintenance of green buildings, homes, and neighborhoods that aims to help building owners and operators be environmentally responsible and use resources efficiently.</p> <hr/> <p>(f) List out various renewable energy sources (any four).</p> <p>Ans.</p> <ol style="list-style-type: none"> 1. Solar energy 2. Wind energy 3. Ocean energy 4. Hydro energy 5. Biomass energy <hr/> <p>(g) State the principle of green building.</p> <p>Ans.</p> <ol style="list-style-type: none"> 1) Sustainable Siting—This approach optimizes land use and development to reduce adverse impacts and minimize the building’s ecological footprint. 2) Energy Efficiency—This technique focuses on the establishment of performance targets that account for intended use, occupancy and other energy operations for new construction and renovation projects. 3) Water efficiency— This technique emphasizes the value of decreasing demands for fresh water and reducing the generation of wastewater through optimized landscaping, integrated rainwater catchments, gray water recycling, and wastewater treatment systems. 4) Building Materials—By using sustainable construction materials and resources, green building materials have aided the reduction of extraction, processing, transportation, solid waste, and consumption. 5) Healthy Indoor Environmental Quality—These processes have enhanced the sustainable communities through ventilation and thermal 	<p><i>1/2m each (any four)</i></p> <p><i>2m</i></p> <p><i>1/2m each (any four)</i></p> <p><i>1m each for any 2 points</i></p>
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<p>Q.2</p>	<p>comfort, moisture control, daylighting, environmental tobacco smoke control, and protecting indoor air quality during construction.</p> <p>Notes: Marks can be given for similar principles.</p> <hr/> <p>(a) Ans. Attempt any THREE of the following: Explain environmental laws for controlling pollution (any four)</p> <p>1. The Environment (Protection) Act, 1986 - The Environment (Protection) Act, 1986 authorizes the central government to protect and improve environmental quality, control and reduce pollution from all sources, and prohibit or restrict the setting and or operation of any industrial facility on environmental grounds. - - The Environment (Protection) Act was enacted in 1986 with the objective of providing for the protection and improvement of the environment. It empowers the Central Government to establish authorities charged with the mandate of preventing environmental pollution in all its forms and to tackle specific environmental problems that are peculiar to different parts of the country. The Act was last amended in 1991.</p> <p>2. The Air (Prevention and Control of pollution) Act, 1981 - The government has passed this act in 1981 to clean up our air by controlling pollution. It states that sources of air pollution such as industry, vehicles, power plants etc. are not permitted to release particulate matter, lead, carbon monoxide, sulfur dioxide, volatile organic compounds or other toxic substance beyond a prescribed level. - This act is created to take appropriate steps for the preservation of natural resources of earth which among other things includes the preservation of high-quality air and ensures controlling the level of air pollution.</p> <p>3. The Water (Prevention and Control of pollution) Act, 1974 - The government formulated this act in 1974 to prevent the pollution of water by industrial, agricultural and house hold waste water that can contaminate our water sources. - The main objective of water act is to provide for prevention, control and abatement of water pollution and the maintenance or restoration of the wholeness of water.</p> <p>4. The Noise Pollution (Regulation and Control) Rules, 2000 - Whereas the increasing ambient noise levels in public places from various sources, inter-alia, industrial activity, construction activity, generator sets, loud speakers, public address systems, music systems, vehicular horns and other mechanical devices have deleterious effects on human health and the psychological wellbeing of the people. - It is considered necessary to regulate and control noise producing and generating sources with the objective of maintaining the ambient air quality standards in respect of noise.</p> <hr/> <p>(b) Ans. State the steps involved in Environmental Impact Assessment process. EIA process-</p> <p>1. Screening – It is the first key decision of EIA process. The purpose of screening is to determine whether a proposal require an EIA or not.</p> <p>2. Initial environmental examination – It is intended as a low-cost environmental evaluation that makes use of information already available.</p> <p>3. Scoping – It refers to early coordination with interested and affected agencies and the public. Scoping identifies important issues and concerns, area</p>	<p>12m</p> <p>1m Each</p>
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	<p>of no concern for a particular project or action and other legislative or regulatory requirements.</p> <p>4. Full scale EIA – It may also identify other environmental review and consultation requirements so that necessary analyses or studies can be made concurrently with EIA.</p> <p>5. EIA Report – a report is formed based on EIA process. It provides a coherent statement of the potential impact of a proposal and the measures that can be taken to reduce and remedy them.</p> <p>6. EIA Review – the purpose of the review is to assure the completeness and quality of the information gathered in an EIA when undertaken as a formal step and acts as a final check on the quality of EIA report.</p> <p>7. Decision Making – EIA is part of a larger process of decision making to approve a major proposal.</p> <p>8. Monitoring – it helps in implementation of EIA results and establishing baseline trends and conditions.</p> <p>9. Environmental Auditing – it is a review process similar to that carried out in financial accounting. Both result in a statement of facts, which certifies that practice is in accordance with standard procedure.</p>	<p>4</p>
<p>(c) Ans.</p>	<p>State the functions of government organization for ECA.</p> <p>Government organization working for Energy Conservation and Audit i.e. ECA and their functions are as follow –</p> <p>1. National Productivity Council (NPC) – It is a national level organization to promote productivity culture in India. It helps to monitor, review and implement identified strategies. It provides reliable database for decision making improved system and procedures, work culture and customer satisfaction.</p> <p>2. Ministry of New and Renewable Energy (MNRE) – It is the nodal ministry of government of India for all matters relating to new and renewable energy. Its function includes facilitating research, design, development, manufacture and deployment of new and renewable energy systems/devices for transportation, application in rural, urban, industrial and commercial sectors.</p> <p>3. Bureau of Energy Efficiency (BEE) – Create awareness and disseminate information of energy efficiency and conservation.</p> <p>4. Maharashtra Energy Development Agency (MEDA) – Working as noble agency in renewable energy sector and state designated agency conservation sector.</p>	<p>1 <i>Marks each</i></p>
<p>d) Ans.</p>	<p>Describe the measures to reduce soil pollution.</p> <p>1. By minimizing the generation of solid waste.</p> <p>2. By reusing and recycling of solid waste such as – paper, metal parts, plastics and glass materials etc.</p> <p>3. By employing proper disposal methods such as – incineration of non-biodegradable solids, composting of biodegradable solids, sanitary landfills, pulverization.</p> <p>4. By treating heavy metals and toxins found in waste liquid pollutants.</p> <p>5. Faulty sanitation practices should be improved.</p> <p>6. Soil erosion should be prevented.</p>	<p>1m each <i>(any four)</i></p>

Q.4	<p>(c) State the limitations of EIA</p> <p>Ans.</p> <ol style="list-style-type: none"> 1) It should be undertaken at project level but it is undertaken at policy and planning level. 2) Project alternatives are limited. 3) There is lack of comprehensive environment information base, limitation of time, manpower and finances. 4) Making process along with traditional economic and technical factors, EIA requires the scientific and value issues to be deal with in a single assessment process. 5) Alternatively predicted adverse effect on the environment might lead to strict conditions of being imposed to avoid. 	1m each																						
	<p>(d) Differentiate between renewable and non-renewable energy sources.</p> <p>Ans.</p> <table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="width: 10%;">Sr no.</th> <th style="width: 45%;">Renewable energy sources</th> <th style="width: 45%;">Non-renewable energy sources</th> </tr> </thead> <tbody> <tr> <td style="text-align: center;">1</td> <td>Energy sources that can be reused called renewable energy sources.</td> <td>Energy sources that can't be reused or nearly impossible to recycle called non-renewable energy sources.</td> </tr> <tr> <td style="text-align: center;">2</td> <td>This type of energy sources do not produce environmental pollution.</td> <td>This type of energy sources do produce environmental pollution.</td> </tr> <tr> <td style="text-align: center;">3</td> <td>These sources are free of cost and available easily.</td> <td>These sources are highly expensive and not easily available.</td> </tr> <tr> <td style="text-align: center;">4</td> <td>Installation of machinery and plants required for utilization of these sources are relatively cheaper than non-renewable energy sources.</td> <td>Installation of machinery and plants required for utilization of these sources are relatively expensive than renewable energy sources.</td> </tr> <tr> <td style="text-align: center;">5</td> <td>These sources are available in much more adequacy.</td> <td>These sources are available in inadequacy.</td> </tr> <tr> <td style="text-align: center;">6</td> <td>Examples – solar energy, water energy etc.</td> <td>Example – nuclear energy, coal energy.</td> </tr> </tbody> </table>	Sr no.	Renewable energy sources	Non-renewable energy sources	1	Energy sources that can be reused called renewable energy sources.	Energy sources that can't be reused or nearly impossible to recycle called non-renewable energy sources.	2	This type of energy sources do not produce environmental pollution.	This type of energy sources do produce environmental pollution.	3	These sources are free of cost and available easily.	These sources are highly expensive and not easily available.	4	Installation of machinery and plants required for utilization of these sources are relatively cheaper than non-renewable energy sources.	Installation of machinery and plants required for utilization of these sources are relatively expensive than renewable energy sources.	5	These sources are available in much more adequacy.	These sources are available in inadequacy.	6	Examples – solar energy, water energy etc.	Example – nuclear energy, coal energy.	1m each (any four)	
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<p>(a) Attempt any <u>THREE</u> of the following:</p> <p>Differentiate between GRIHA and IGBC rating system of green building.</p> <p>Ans.</p> <table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="width: 10%;">Sr no.</th> <th style="width: 45%;">GRIHA rating system</th> <th style="width: 45%;">IGBC rating system</th> </tr> </thead> <tbody> <tr> <td style="text-align: center;">1</td> <td>GRIHA – Green Rating for Integrated Habitat Assessment.</td> <td>IGBC – Indian Green Building Council.</td> </tr> <tr> <td style="text-align: center;">2</td> <td>It assesses building based on four categories and awards points on a scale of 100</td> <td>It assesses building based on five categories and awards points on a scale of 100.</td> </tr> <tr> <td style="text-align: center;">3</td> <td>An initiative of TERI (The Energy And Resource</td> <td>An initiative of US-based LEED (Leadership of Energy and</td> </tr> </tbody> </table>	Sr no.	GRIHA rating system	IGBC rating system	1	GRIHA – Green Rating for Integrated Habitat Assessment.	IGBC – Indian Green Building Council.	2	It assesses building based on four categories and awards points on a scale of 100	It assesses building based on five categories and awards points on a scale of 100.	3	An initiative of TERI (The Energy And Resource	An initiative of US-based LEED (Leadership of Energy and	1m each (any four)	12m										
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Model Answer: Winter 2019

22506

Subject: Energy conservation and Green building

Subject Code

	Institute) and MNRE (Ministry of New and Renewable Energy)	Environmental Design) started in 2003 by CII	
4	In this Indian standard codes are used.	In this no Indian standard code is used.	
5	Five star rating system 1. 50-60 points is certified as a 1 star GRIHA rated building, 2. 61-70 is a 2 star GRIHA rated building, 3. 71-80 is a 3 star GRIHA rating building 4. 81-90 is a 4 star GRIHA rated building 5. 91-100 is a 5 star GRIHA rated building	Four category rating system. 1. Certified – 40 - 49 points 2. Silver – 50 - 59 points 3. Gold – 60 - 79 points 4. Platinum – 80 points and above	
(b)	Explain about any two types of construction projects requiring environmental clearance.		
Ans.	Environment clearance is necessary for a few categories of construction projects and area development projects under the new EIA notification 2006 as amended from time to time as per the two types of construction projects requiring environmental clearance.		2m
	<p>1) Building and construction project: Built up area between 20,000 to 1,50,000 sq.m.. or built up area – the built up area for the purpose of this notification is defined as the built up or covered area on all the floor put together including basement and other service area which are proposed.</p> <p>2) Township and area development projects – covering an area greater than or equal to 50 ha. and /or built up area greater than or equal to 1, 50,000 sqm. All such projects shall be appraised as project category B1 for environmental clearance.</p>		2m
(c)	Explain four Environmental design (ED) strategies for building construction.		
Ans.	<p>1. Passive Sustainable Design. Passive strategies, such as considering sun orientation and climate when siting and being thoughtful about window placement and operation, are used to best manage daylighting and natural ventilation and go a long way in reducing energy requirements for the building. In certain climates, thermal mass techniques can be used to harness solar energy. In such cases, thick walls absorb heat from the sun during the day and release it into the building at night.</p> <p>2. Active Sustainable Design. Architects consult with mechanical and electrical engineers to implement high-efficiency electrical, plumbing, HVAC, and other systems, which are designed to have small environmental footprints.</p> <p>3. Renewable Energy Systems Renewable energy systems, including</p>		1m each



Model Answer: Winter 2019

22506

Subject: Energy conservation and Green building

Subject Code

those that harness solar and wind energy, are also great options for some buildings. These systems are often used in conjunction with passive design strategies

4. **Green Building Materials and Finishes.** By making it a priority to purchase steel, lumber, concrete, and finishing materials, such as carpet and furnishings, from companies that use environmentally responsible manufacturing techniques or recycled materials, architects up the ante on sustainability.
5. **Native Landscaping.** Landscaping choices can make a big impact in civic building water consumption. By using trees, plants, and grasses that are native to the area, architects can greatly reduce irrigation needs. Landscaping can also be used as part of a passive energy strategy. By planting trees that shade the roof and windows during the hottest time of the day, solar heat gain inside the building can be reduced.
6. **Stormwater Management.** When rain falls on an untouched site, the water that doesn't evaporate absorbs back into the ground, replenishing the natural water table. However, when a building is placed on the site, along with parking lots, sidewalks, access roads, and other hardscaping, rainfall behaves differently. The water runs off these surfaces and into storm drains. By implementing stormwater management strategies, such as pervious pavement that helps to reduce runoff and retention ponds that capture runoff and slowly release water back into the ground, the negative environmental impact of buildings can be reduced.

OR

1. Site selection
2. Architectural design for sustainability.
3. Indoor environmental quality
4. Building energy use- mechanical systems
5. Building lighting, equipment, energy management and utilities
6. Materials and resources
7. Construction
8. Commissioning

4m

Note; Marks may be given for any of the above points or similar points.

Explain the role of HVAC system in green building.

**(d)
Ans.**

1. Green energy conservation, indoor air quality and comfort are among the core green building issues encompassed by heating, air-conditioning and ventilation design.
2. The interrelated system can be complex, expensive to install and costly to operate but green building also offers many opportunities to simplify and save.
3. HVAC – Heating, ventilation and air-conditioning system is more than a few pieces of mechanical equipment. It's a system designed as part of house.
4. An HVAC system works best when it takes local climate and building design into account.
5. In a green built home, heating and cooling equipment can be smaller, less costly and of less complicated.

**1m each
(any
four)**

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Q.5	(e) Ans.	<p>State the benefits of EIA to environment.</p> <ol style="list-style-type: none"> 1. It provide information for decision making on the environmental consequences of proposed action. 2. It improves the environmental design of the proposal. 3. It Ensure that resources are used appropriately and efficiently. 4. It facilitate informed decision making, including setting the environmental terms and conditions for implementing the proposal. 5. It helps to protect human health and provide safety. 	6m	
	(a) Ans.	<p>Attempt any TWO of the following :</p> <p>Explain the role of MEDA in energy conservation in city.</p> <p>MEDA (Maharashtra Energy Development Agency) is a Maharashtra government institution run with the Federal Government of India, to regulate energy conservation and to promote the development of renewable energy in Maharashtra state including solar energy, bio energy and wind energy is registered as a society under Societies Registration Act, 1860 (in 1985) and Bombay public trust 1950 (in 1987)</p>	12m	
	(b) Ans.	<p>Functions of MEDA:</p> <ol style="list-style-type: none"> 1) To assist the state and central government for promoting and developing new and renewable sources of energy and technologies and also promoting and implementing the energy conservation. 2) To work as state nodal agency in renewable energy sector and state designated agency energy conservation sector. 3) To explore the resources such as wind, bagasse, hydro, biomass, geothermal, wave and ecofriendly in nature. 4) To encourage power generation through renewable energy sources. 5) To create mass awareness about increasing need for energy conservation. <p>Explain the salient provisions used in IGBC.</p> <ol style="list-style-type: none"> 1) The Indian Green Building Council (IGBC), part of the Confederation of Indian Industry (CII) was formed in the year 2001. The vision of the council is, "To enable a sustainable built environment for all and facilitate India to be one of the global leaders in the sustainable built environment by 2025". 2) The council offers a wide array of services which include developing new green building rating programs, certification services and green building training programs. 3) The council also organizes Green Building Congress, its annual flagship event on green buildings. 4) The council is committee-based, member-driven and consensus-focused. All the stakeholders of construction industry comprising of architects, developers, product manufacturers, corporate, Government, academia and nodal agencies participate in the council activities through local chapters. 5) The council also closely works with several State Governments, Central Government, World Green Building Council, bilateral multi-lateral agencies in promoting green building concepts in the country. 	6m	



<p>Q.6</p>	<p>(c) Ans.</p>	<p>Explain the concept of green building.</p> <ol style="list-style-type: none"> 1. A green building in incorporates environmental conservation into every stage of the building construction and focuses on the decision, construction, operation and maintenance phase. 2. In green building concept multidisciplinary team of building professional work together from the pre decision phase through post occupancy to optimize the building for environmental sustainability, performance and cost saving. 3. Green building in corporates superior air quality, abundant natural lights, access to view and noise control which benefits building occupants, making these building better place to work or live. 4. Green building operations promote material as well as water recycling in their operation. 5. Energy efficiency is one the most important factors in green building concept. 6. Green concept also stress on water conservation by implementing more efficient water delivery and recycling system. 	<p><i>1m Each</i></p>	
	<p>(a) Ans.</p>	<p>Attempt any TWO of the following: Explain the principles of green building used in educational building.</p> <p>National institute of building sciences defines six fundamental principles –</p> <ol style="list-style-type: none"> 1. Optimize site potential – Whether designing a new building or retrofitting an existing building, site design must integrate with sustainable design to achieve a successful project and begins with the proper site selection, including the existing building rehabilitation. 2. Optimize energy use – Improving the energy performance of existing building is important to increase our energy independence. Operating net zero energy building is one way to significantly reduce our dependence on fossil fuel derived energy. 3. Protect and conserve water – A sustainable building should use water efficiently and reuse or recycle water for on-site use when feasible. 4. Optimize Building space and material use – A sustainable building is designed and operated to use and reuse material in the most productive and sustainable way across its entire life cycle. 5. Enhance Indoor Environmental Quality – The indoor environmental quality of a building has a significance impact on occupant health, comfort and productivity. Among other attributes, a sustainable building minimizes day lighting, has appropriate ventilation and moisture control, optimizes acoustic performance and avoids the use of material with high VOC Emission. 6. Optimize operational and maintenance practices – Designers can specialty materials and systems that simplify and reduce maintenance requirements, require less water, energy and toxic chemicals and cleaners to maintain and are cost effective and reduce life cycle costs. 	<p><i>1m each (any six)</i></p>	<p><i>12m</i></p>
<p>(b) Ans.</p>	<p>Explain in details the need of energy conservation.</p> <ol style="list-style-type: none"> 1. As the source of energy are limited it is getting more difficult to recycle and reuse. Hence need for energy conservation techniques to deal with energy insufficiency. 2. Non-renewable energy sources are good to use but the problem with these sources is that they are highly difficult or can't be renewed for reuse. 			



Model Answer: Winter 2019

22506

Subject: Energy conservation and Green building

Subject Code

<p>(c) Ans.</p>	<p>3. Energy conservation helps in achieving higher rate of production for the same energy consumption with higher rate of production.</p> <p>4. Energy conservation helps in saving money which can be used in other productive means.</p> <p>5. It helps to understand more about the ways different energy sources are used in the industry and helps to identify areas where waste can occur and where scope for improvement may be possible.</p> <p>6. It helps to balance total inputs of energy with its use.</p> <p>7. It makes us feel responsible for our day to day activities that causes more consumption of energy and how to reduce the consumption rate and wastage of energy.</p> <p>8. Conservation of energy from every place may lead to better development of country by saving financial investment in production of unnecessary energy.</p> <hr/> <p>Explain benefits to the school after getting IGBC green rating certification for school building.</p> <p>The benefits to the schools can be broadly categorized under performance, pedagogy, community and responsibility.</p> <p>1. Performance (student and building performance) – fresh air, daylight, improved indoor environment enhances the performance of students. Also water efficiency, energy efficiency and post monitoring improves building performance.</p> <p>2. Pedagogy (science and art of education) – eco – sensitivity is both a passion and science. Children get sensitized to environmental aspects.</p> <p>3. Community (help to educate the greater community) – knowledge sharing within the school helps in reaching out to parents and nearby communities.</p> <p>4. Responsibility (toward environment) – children learn to take responsibility for their own actions that concerns the environment.</p> <p>Schools can have tremendous benefits, both tangible and intangible. The most tangible benefits are the reduction in water and energy consumption. Intangible benefits include health & wellbeing of children, enhanced air quality and excellent day lighting.</p>	<p>6m</p> <p>6 m</p>	
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