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# B.M.S. College of Engineering, Bengaluru-560019

**Autonomous Institute Affiliated to VTU**

## September / October 2023 Supplementary Examinations

**Programme: B.E.** **Semester: VIII**
**Branch: Institutional Elective** **Duration: 3 hrs.**
**Course Code: 21CV8OESLA** **Max Marks: 100**
**Course: Sustainability and Lifecycle Assessment**

**Instructions**: 1. Answer any FIVE full questions, choosing one full question from each unit.
2. Missing data, if any, may be suitably assumed.





| | | UNIT - I | CO | PO | Marks |
|---|---|---|---|---|---|
| 1 | a) | Explain the meaning of Sustainable development using a Venn diagram representing the "sustainable" solution. List out any 3 products/ materials/ components/ processes/ systems/ technologies for each of the zones of the Venn diagram. Justify your answer by two facts/points | *CO1* | *PO3* *PO7* | **08** |
| | b) | The following data is given for different modes of transportation. | *CO1* | *PO3* *PO7* | **06** |

| Vehicle type | Life span of the vehicle (years) | Initial Cost of the vehicle (Rs.) | Seating Capacity | Mileage (km/litre of fuel) | Fuel type | Emission rates (kg of CO2/litre of fuel) |
|---|---|---|---|---|---|---|
| Type-1 | 15 | 19,00,000 | 7 | 12 | Petrol | 3.45 |
| Type-2 | 12 | 23,00,000 | 7 | 10 | Diesel | 2.87 |
| Type-3 | 12 | 16,00,000 | 7 | 15 | Petrol | 2.15 |
| Type-4 | 11 | 14,00,000 | 5 | 14 | Diesel | 4.52 |

If the cost of the petrol and diesel are Rs.101 and Rs.95 respectively, suggest the better vehicle in terms of sustainability with proper reasons.

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| | c) | Consider the following engineering products and list any two technical and non-technical parameters (from any system boundary) for each of them;<br>i) Mobile phone<br>ii) Car<br>iii) IC Engine<br>iv) Sewage treatment plant<br>v) Solar panels | *CO1* | *PO3* *PO7* | **06** |
| | | **UNIT - II** | | | |
| 2 | a) | What are Eco-indicators? Explain the factors to be considered for designing a viable sustainable development indicator. | *CO1* | *PO3* *PO7* | **06** |

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| | b) | Prepare a table comparing any 4 differences between 'conventional engineering' and 'sustainable engineering' | *CO1* | *PO3*<br>*PO7* | **06** |
| | c) | What do you mean by integrated solid waste management? Explain the different methods of minimizing waste generation to promote sustainable development. | *CO1* | *PO3*<br>*PO7* | **08** |
| | | **UNIT - III** | | | |
| 3 | a) | Explain<br>i. Physical life<br>ii. Functional life<br>iii. Technical life<br>iv. Economical life<br>v. Legal life<br>vi. Obsolescence life<br>with the help of an example for each | *CO3* | *PO3*<br>*PO7* | **12** |
| | b) | What is the difference between (i) embodied energy and (ii) use-of-product energy? Explain with an example. | *CO3* | *PO3*<br>*PO7* | **08** |
| | | **OR** | | | |
| 4 | a) | Give two examples of when the following life-cycle is considered: (i) cradle-to-gate, (ii) gate-to-gate, (iii) cradle-to-grave. | *CO3* | *PO3*<br>*PO7* | **06** |
| | b) | For the materials listed discuss the upstream and down stream factors to be considered :<br>i. Automobile<br>ii. Phone<br>iii. Timber<br>iv. Solar panels | *CO3* | *PO3*<br>*PO7* | **06** |
| | c) | The inventory data collected for manufacturing of one tonne (unit) of cement from a cement industry as shown below in the table | | | **08** |

| *Process/stage* | *Type of fuel used* | *Quantity* | *Unit* | *Energy conversion factor* | *Unit* | *$CO_2$ Emission conversion factor* | *Unit* |
|---|---|---|---|---|---|---|---|
| Raw material extraction stage | Diesel | 4.36 | kg/unit | 35.56 | MJ/kg | 2.45 | kg/kg |
| | Electricity | 5.78 | kWh/unit | 11.22 | MJ/kWh | 0.92 | kg/kWh |
| Transportation | Petrol | 2.56 | kg/unit | 38.64 | MJ/kg | 2.72 | kg/kg |
| Processing | Electricity | 62.54 | kWh/unit | 11.22 | MJ/kWh | 0.92 | kg/kWh |
| packing | Electricity | 1.15 | kWh/unit | 11.22 | MJ/kWh | 0.92 | kg/kWh |

Estimate the total energy use and carbon dioxide emission for manufacturing of one tonne of cement.

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| | | **UNIT - IV** | | | |
| 5 | a) | What is the purpose of Life Cycle Analysis (LCA)? Explain with a neat sketch the different stages of LCA. | *CO2* | *PO3*<br>*PO7* | **08** |
| | b) | Discuss the benefits and limitations of LCA | *CO2* | *PO3*<br>*PO7* | **06** |

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| | | c) | What do you mean by functional unit (FU)? Explain the goals of performing inventory analysis for LCA study. | *CO2* | *PO3*<br>*PO7* | **06** |
| | | | **OR** | | | |
| | 6 | a) | Explain with a neat sketch the different type of boundary conditions used in performing LCA | *CO2* | *PO3*<br>*PO7* | **06** |
| | | b) | If there is a sudden decision to remove all the vehicles from the road that fails to meet emission and safety norms and as a citizen of that place, give your views on the enforced regulation with proper justification. | *CO2* | *PO3*<br>*PO7* | **06** |
| | | c) | Explain in detail the Life Cycle Assessment pattern for a cement industry. | *CO2* | *PO3*<br>*PO7* | **08** |
| | | | **UNIT - V** | | | |
| | 7 | a) | What is Life Cycle Impact Assessment? Explain the key steps involved in performing Life Cycle Impact Assessment. | *CO3* | *PO3*<br>*PO7* | **08** |
| | | b) | Explain any three Impact Categories of Life Cycle Analysis. | *CO3* | *PO3*<br>*PO7* | **06** |
| | | c) | What do you mean by Eco-audit? With the help of a flow chart, explain the approach to be followed for the eco-design of products. | *CO3* | *PO3*<br>*PO7* | **06** |

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