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

Autonomous Institute Affiliated to VTU

May / June 2025 Semester End Main Examinations

Programme: B.E. **Semester: VIII**

Branch: Institutional Elective **Duration: 3 hrs.**

Course Code: 22CV8OESLA **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.

Important Note: Completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages. Revealing of identification, appeal to evaluator will be treated as malpractice.

				CO	PO	Marks
			UNIT - I			
1	a)		Illustrate with neat sketch the three pillars of sustainable development.	*CO1*	*PO6, PO7*	**10**
	b)		Elucidate the challenges to Sustainability and ISO Framework of LCA.	*CO1*	*PO6, PO7*	**10**
			OR			
2	a)		Discuss any five sustainable development goals (SDG's).	*CO1*	*PO6, PO7*	**10**
	b)		Illustrate any five best practices for making the industrial process to move towards the goal of sustainability.	*CO1*	*PO6, PO7*	**10**
			UNIT - II			
3	a)		Explain the necessity of Sustainable Development Indicator (SDI) and also Discuss the criteria for a viable SDI.	*CO2*	*PO6, PO7*	**10**
	b)		Write a brief note on GHG emissions and developing eco-indicators.	*CO2*	*PO6, PO7*	**10**
			OR			
4	a)		Discuss different themes of SDI. Also explain the process of grouping of indicators.	*CO2*	*PO6, PO7*	**10**
	b)		Illustrate different types of environmental impact categories.	*CO2*	*PO6, PO7*	**10**
			UNIT - III			
5	a)		Explain different forms of energy and energy conversion efficiency.	*CO2*	*PO6, PO7*	**10**
	b)		An alloy has been manufactured by the combination of Copper, Nickel, and Zinc in the ratio of 3:1:2. The average energy and	*CO2*	*PO6, PO7*	**10**

carbon emission factors & the distance travelled for transporting of each material to the manufacturing unit is as shown in the table below.

Name of the metal	Energy factors (GJ/tonne)	Emission factors (kg/tonne)	Average distance travelled (km)
Copper	35.0	3530	150
Nickel	110.0	20,000	80
Zinc	54.0	5890	100

The processing energy factor for making of alloy was found to be 30 GJ/T. Assuming that, all the vehicles used for transporting of materials has same mileage factor of 10 km/litre and specific energy of diesel is 42 MJ/litre, carbon emission factor 2.68 kg/litre, determine the total embodied energy and carbon dioxide emission for the manufacturing of alloy.

OR

6 a) Discuss with a neat sketch the Lifecycle pattern of car or refrigerator (any one). Discuss the inflows and outflows at each stage. *CO2* *PO6, PO7* **10**

b) The structure of a steel-framed building requires, 700 kg of standard concrete (foundation) and 150 kg of steel (100% recycled) per square meter area. The enclosure requires 3 m^2 of 0.1 m fiberglass insulation and 8.5 m^2 of 19 mm plywood. Determine the total embodied energy and total carbon footprint of structure plus enclosure. The unit energy and carbon footprint values for the materials are as given in the table below. *CO2* *PO6, PO7* **10**

Material	Density (kg/m3)	Embodied energy (MJ/kg)	Carbon footprint (kg/kg)
Standard Concrete	2400	1.14	0.1
Steel (100% Recycled)	7850	7.3	0.57
Insulation fiber glass	32	30.3	2.1
Plywood	600	10.4	0.8

UNIT - IV

7 a) Discuss different components of Lifecycle assessment (LCA) with the help of a flow chart. Explain the benefits and limitations of LCA. *CO3* *PO6, PO7* **10**

b) Illustrate (i) Process based analysis, (ii) input-output analysis and (iii) hybrid analysis in performing Lifecycle assessment. *CO3* *PO6, PO7* **10**

			OR			
	8	a)	Explain with a neat sketch the different type of boundary conditions used in performing LCA.	*CO3*	*PO6, PO7*	**10**
		b)	With the help of a flow chart explain Life Cycle Inventory (LCI) analysis and factors influencing LCI.	*CO3*	*PO6, PO7*	**10**
			UNIT - V			
	9	a)	What is Life Cycle Impact Assessment? Discuss the benefits and limitations of conventional and non-conventional sources of energy.	*CO3*	*PO6, PO7*	**10**
		b)	Illustrate the process of interpretation and decision making for different set of alternatives.	*CO3*	*PO6, PO7*	**10**
			OR			
	10	a)	A manufacturing industry has four stages in product manufacturing as shown in the Figure Q 10(a) below. The released environmental burdens are indicated in Table Q10 (a). Table Q10(b) shows the classification factors for different impact categories. Evaluate the environmental impact categories of global warming and acidification due to the burdens.	*CO3*	*PO6, PO7*	**10**

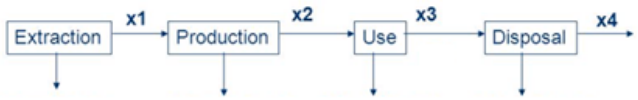

Figure Q 10(a)

Table Q10 (a): Released environmental burdens

Stage	Energy/mass flow (x) (t/tFU)	CO_2 (kg/t)	CH_4 (kg/t)	SO_2 (kg/t)	NO_x (kg/t)
X1	4.5	0.6	0.21	0.04	0.02
X2	3.6	0.7	0.25	0.05	0.02
X3	2.8	0.5	0.22	0.03	0.01
X4	2.2	0.3	0.15	0.001	0.000

Table Q10 (b): Impact categories for burdens

Impact categories → / Burdens ↓	Global warming factor	Acidification factor
CO_2	1	-
CH_4	21	-
SO_2	-	1
NO_x	-	0.7

		b)	Discuss different methods of waste management for the sustainable development	*CO3*	*PO6, PO7*	**10**

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