KUMARAGURU
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Register Number:……

M.E DEGREE EXAMINATIONS: APRIL / MAY 2023

(Regulation 2018)

Second Semester

ENVIRONMENTAL ENGINEERING

P18EEE0005**:** Environmental System Analysis

COURSE OUTCOMES

CO1: Identify a system and its behavior.

CO2: Formulate a system for an environmental process.

CO3: Suggest the choice of linear / Non-linear algorithm based on the system constraints.

CO4: Understand the process or parameters or criteria that may influence a decision.

CO5: Appreciate the role of systems thought in LCA, circular economy and sustainable development.

Time: Three Hours **Maximum Marks: 100**

Answer all the Questions:-

PART A (10 x 1 = 10 Marks)

1. Whether the parameters of the evolutionary algorithm are considered as decision variables CO3 [K_1]

   a) Yes
   b) Yes, Based on the case of consideration
   c) No
   d) Yes, based on the constraints defined or structured

2. The historical database length of the variables in the system decides upon CO2 [K_2]

   a) Framework as linear or non-linear system
   b) Has no influence on the system formation
   c) Has the influence in the choice of solving technique or algorithm
   d) Which suggest the applicability of the evolutionary algorithms

3. The evolutionary algorithms are used to determine the optima of a given system for a predefined objective function. In this case, whether pareto front formed by the objective function will be useful to CO3 [K_2]

   a) Define the optima from the user end
   b) To understand the uncertainty
   c) To evaluate the parameters of the system
   d) to understand the objective sensitivity

4. Match the list-1 and list 2 CO4 [K_2]

List I (Objective)	List II (Tradeoff criteria)
A. Water quality of the treated effluent within the firm for reuse in the production cycle	i. Socio-economic
B. Water quality of the treated effluent discharged outside the firm boundary	ii. Environment and socio-economic
C. Water quality of the treated effluent discharged outside the firm boundary for reuse into the agricultural sector	iii. Environment
D. assessing the impact of industry in a particular locality	iv. Economic

a) iv, iii, ii, i
b) i, ii, iii, iv
c) iii, iv, i, ii
d) iii, iv, ii, i

5. If the decision makers struggle to find a optima especially in case of consideration to environment and the associated cost. In the following, which criteria may help to decision maker to identify the optima of the system CO4 [K_2]

a) Environmental impact
b) Socio-economic analysis
c) Technical perspective
d) A nexus between environmental, and socio-economic

6. The solution arrived from a predefined objective function, whether it is suitable for CO3 [K_2]

a) a general case as a global solution
b) A case of similar physical nature where target remains same
c) A case of similar statistical nature where the target remains same
d) Only the structured case

7. Assertion (A): Interdependent and interconnectivity between variables of the system CO1 [K_1]
Reason (R): will ensure to achieve predefined objective or target or goal

a) Both A & R is right, R is the correct reason for A
b) Both A & R is right, R is not the correct reason for A
c) A is wrong, R is right
d) A is correct , R is wrong

8. When defining a system whether it requires CO1 [K_1]

a) Basic structure to attain a predefined achieve
b) To be open ended
c) Non structure arrangement
d) Complexity to resolve

9. Find the valid statements from the followings CO2 [K_2]

i. Statistical characteristics of a database suggest the choice towards the selection of particular solving technique or modelling framework

ii. Normally the historical database is considered to follow uniform distribution function

iii. Length of the database does not influence the simulation results

iv. Random input selection will result into a better uncertainity addressing model

a) i b) i,ii

c) i,ii,iii d) iv

10. The solution of a system is highly influenced by CO1 [K_2]

a) Solving technique b) Objective function variability

c) Constraints and solving technique d) Objective function and constraints

PART B (10 x 2 = 20 Marks)

11. What do you understand by the term "System"? Give an example CO1 [K_2]
12. List the various types of system. CO1 [K_1]
13. Whether length of historical database has influence on system formulation. Justify your view. CO2 [K_2]
14. Whether unconstrained system formulation will reduce the performance of system response or convergence. Justify your stand. CO2 [K_2]
15. What do you understand by the terms "Slack and Surplus variable"? CO3 [K_2]
16. Whether objective sensitivity need to be performed irrespective of the system complexity. Justify your view. CO3 [K_2]
17. What do you understand by the term" Pareto front? CO4 [K_2]
18. State the merits and demerits of cost benefit ratio analysis in decision making CO4 [K_2]
19. List the stages and uses of LCA. CO5 [K_1]
20. What do you understand by the term sustainable indicator? Give any two examples. CO5 [K_2]

PART C (6 x 5 = 30 Marks)

21. Discuss on the properties of a system. CO1 [K_2]

22. Classify linear and non-linear system with a case example. CO2 [K_2]

23. Discuss on the role of optimization algorithm in solving a formulated system. Illustrate with a case example. CO3 [K_3]

24. Discuss the role of environmental concern in decision making. CO4 [K_2]

25. Discuss on the Cradle to Cradle Approach in LCA with an example CO5 [K_2]

26. What are the 4 main concepts of circular economy? Explain. CO5 [K_2]

Answer any FOUR Questions
PART D (4 x 10 = 40 Marks)

27. A reservoir is supposed to operate for multipurpose (drinking, irrigation, and hydro power) demands of the stakeholders. Formulate the system (you may assume required data) and comment on the system behavior in terms of complexity. CO1 [K_4]

28. A waste water treatment plant operated in a firm is undergoing expansion, and the firm request is to optimize the structural components in order to reduce the cost of investment with up to 10 % compromise on the treatment efficiency. Formulate the system (you may assume required data) defining objective in terms of scenario 1(on cost of the plant), and scenario 2 (on treatment efficiency of the plant). Comment on the influence of objective function on decision making CO2 [K_4]

29. A waste water treatment plant operated in a firm is undergoing expansion, and the firm request is to optimize the structural components in order to reduce the cost of investment with up to 8 % compromise on the treatment efficiency. Formulate the system (you may assume required data) defining objective in terms of cost. Discuss on the approach to solve the formulated system as a linear system. CO3 [K_4]

30. Explain in detail about the Analytical Hierarchy Process and its role in decision making. CO4 [K_2]

31. Discuss the influence of LCA in recommending or suggesting feasible option from the list of alternatives suggested by firm in their production process. CO5 [K_4]

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