



Department of Aerospace Engineering  
IIST, Thiruvananthapuram  
**Multi-disciplinary Optimisation**  
**(AE 844)**

**9:00-10:00AM**

28/03/2018

(D4-C104)

Maximum Marks: 15

**Note:**

1. All questions are compulsory.
2. Clearly state all the assumptions/approximations in the derivations/answers.

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1. Which parameter should a designer change in GA to make the algorithm perform more exploration and less exploitation? [1]
  2. What governs the length of the chromosome in binary GA? [1]
  3. Outline two disadvantages and advantages of GA over gradient optimisation algorithms. [2]
  4. Compare the performance of finite difference method (FVM) with the complex variable method (CVM) as far as the accuracy, computational cost and ease of implementation are concerned. Can CVM be implemented for all analysis tools (CFD/FEM codes/packages) used in optimisation? [2 + 1]
  5. How many function evaluations will be required to approximate the entire Hessian matrix for the objective function  $\mathbf{f}(\mathbf{x})$  where  $\mathbf{f} \in \mathbb{R}^m$  and  $\mathbf{x} \in \mathbb{R}^n$  using central finite difference approximation? [2]
  6. Minimise  $f_1(x, y) = x^3 + y^2$ ,  $f_2(x, y) = y^2 - 4x$ 
    1. Using the weight vector  $\mathbf{w} = (w, 1-w)^T$ , find the Pareto-optimal solutions in terms of  $w$ .
    2. What is the relationship between  $f_1$  and  $f_2$  for the Pareto-optimal solutions?
    3. What is the Pareto-optimal solution corresponding to  $w = 0.5$ ?
    4. Show that the weighted-sum approach will not find half of the Pareto-optimal front.

[2 + 1 + 1 + 2]