Reg. No.										

Manipal Institute of Technology, Manipal

(A Constituent Institute of Manipal University)

VI SEMESTER B.TECH (OPEN ELECTIVE - II)

END SEMESTER EXAMINATIONS, MAY 2016

SUBJECT: ENGINEERING DESIGN OPTIMIZATION [MME-374]

REVISED CREDIT SYSTEM

Time: 3 Hours MAX. MARKS: 50

Instructions to Candidates:

- Answer **ANY FIVE FULL** questions.
- Missing data may be suitable assumed.

1A) Define optimization. Write any 8 engineering applications of optimization. **(03)**

1B) Explain basic components of optimization with any two examples? **(04)**

1C) Write the steps in general numerical algorithm for solving unconstrained optimization. **(03)**

2A) State and prove necessary and sufficient conditions of unconstrained multi variable optimization. **(04)**

2B) State Karush Kuhn tucker conditions. **(03)**

2C) Explain the need for numerical methods of optimization. **(03)**

3A) Determine the dimensions of an open box of maximum volume that can be constructed from an A4 (210mm X 297mm) sheet by cutting four squares of side x from corners and folding and gluing the edges. **(05)**

3B) Find the dimensions of a cylindrical tin (with top and bottom) made up of sheet metal to maximize its volume such that the total surface area is equal to $A_0 = 24\pi$ using the method of Lagrangian multi pliers. **(05)**

4A) What do you mean by a posynomial? Give an example. **(02)**

4B) It has been decided to shift grain from a warehouse to a factory in an open rectangular box of length x_1 meters, width x_2 meters, and height x_3 meters. The bottom, sides, and the ends of the box cost, respectively, \$70/m^2, \$12/m^2, and \$22/m^2. It costs \$1.5 for each round trip of the box. Assuming that the box will have no salvage value, find the minimum cost of transporting 90m^3 of grain. **(05)**

4C) Explain any two methods of multiobjective optimization. **(03)**

5A) Minimize $f(x_1,x_2)= x_1^2+x_2^2-2x_1x_2$ using the steepest-descent method starting from point (1, 0). [hint = analytical method may be used to find step size α] **(04)**

5B) Explain golden section search method for step size determination. **(04)**

5C) For the function $f(x)= x_1^2-x_1x_2+2x_2^2-2x_1+e^{(x_1x_2)}$. check if the direction d=(2,1) at point (0, 0) is a descent direction for the function f. **(02)**

6A) Explain how practical optimization formulation can be done for design of truss member. **(05)**

6B) Formulate following optimization design problem: design a can to hold at least 400 ml of liquid, as well as with minimum sheet metal. The diameter should be no more than 8cm and no less than 3.5cm, whereas the height should be no more than 18cm and no less than 8 cm. state all five steps involved. **(05)**

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