Modal question

Eight Semester B.Tech Degree Examination April /May 2012

Branch CIVIL

08.807. 7 Elective – V OPIMISATION TECHNIQUES IN ENGINEERING

Time 3hrs. **Max Marks:100**

Part A

Answer all Questions

I.
- a. Explain the general steps involved in the formulation of optimisation model
- b. What is meant by operation research? List various mathematical programming techniques.
- c. Differentiate between constrained and unconstrained optimisation problems. What are the necessary and sufficient conditions for the minimum and maximum of a function of several variables without constrai+-nts?
- d. With the help of the flow chart explain the algorithm for Fletcher and Reeves method
- e. Minimise $z = x_1 - x_2 + 2x_1^2 + 2x_1x_2 + x_2^2$ by taking the starting point $x_1 = \begin{Bmatrix} 0 \\ 0 \end{Bmatrix}$ using Newton's method
- f. What is duality of LP problems? Write the dual of the primal problem

$$Maximise\ z = 5x_1 + 6x_2$$

Subject to

$$x_1 + x_2 = 5$$
$$-x_1 + 5x_2 \geq 3$$
$$4x_1 + 7x_2 \leq 8$$

x_1 unrestricted, $x_2 \geq 0$

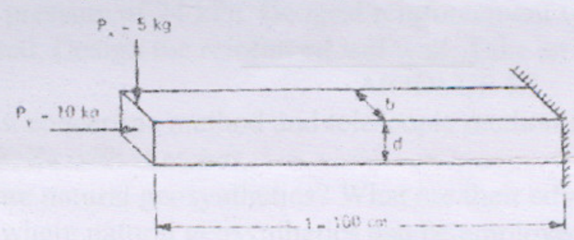
- g. What is dynamic programming? State and explain Bellman's principle of optimality?
- h. Describe the principle of valid cut used in solving integer programming problem.

(8x5=40 Marks)

PART B

MODULE 1

II a) A beam-column of rectangular cross section has to carry an axial load of 10kg and a traverse load of 5kg as shown in fig 1. It has to be designed to avoid the possibility of yielding and buckling and for minimum weight. By assuming that the beam column can bend only in vertical (xy) plane, formulate the optimisation problem. Assume the material as steel with a density of 0.0074kg/cm^2. Youngs modulus 2.1x10^{6}kg/cm^2, and a yield stress of 2100 kg/cm^2. The width of the beam should be at least 1 cm and must not be greater than twice depth.



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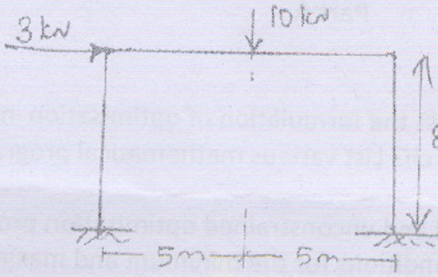
b) Chem. Labs uses raw materials I and II to produce two domestic cleaning solutions A and B. The daily availability of raw materials I and II are 150 and 145 units respectively. One unit of solution A consumes 0.5 units of raw material I and 0.6 units of raw material II and one units of solution B uses 0.5 units of raw material one and 0.4 units of raw material II. The profit /units of solutions A and B are Rs.8 and Rs.10 respectively. The daily demand for solution A lies between 30 and 150 units and that for solution B between 40 and 200 units. Formulate the given problem. 8

OR

III. For the portal frame given in figure, formulate an optimization model for the minimum weight design. Assume that the collapse mechanisms are the plastic hinge formation at points (1,2,6,7), (3,4,5), (1,4,5,7) and (1,3,5,7) and weight is a linear function of beam moment capacity and column moment capacity:



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MODULE II

IV $Maximise\ f(x_1,x_2) = 4x_1 + x_2 - 2x_1^2 - 2x_1x_2 - 2x_2^2$ Using the steepest ascent method with the starting point (1,1). 20

OR

V Find the minimum of the function
$x^2 - 4x + 2\ \ in\ the\ interval 0 \leq x \geq 5\ using\ the\ Fibinacci\ search\ method$ 20

MODULE 3

VI Solve the following integer programming problem

$$Maximise\ z = 2x_1 + 2x_2$$

Subject to

$$5x_1 + 3x_2 \leq 8$$
$$2x_1 + 4x_2 \geq 8$$

$x_1, x_2 \geq 0$

20

OR

VII Use the two phase simplex method to

$$Minimise\ z = 2x_1 + 3x_2$$

Subject to

$$0.5x_1 + 0.25x_2 \leq 4$$
$$x_1 + 3x_2 \geq 20$$
$$x_1 + x_2 = 10$$

$x_1, x_2 \geq 0$

20
