Registration no: | | | | | | | | | | |

Total Number of Pages: 02 **M.TECH**

CEPE204

2nd Semester Back Examination – 2016-17

STRUCTURAL OPTIMISATION

BRANCH(S): STRUCTURAL & FOUNDATION ENGG, STRUCTURAL ENGG

Time: 3 Hours

Max Marks: 70

Q.CODE: Z851

Answer Question No.1 which is compulsory and any five from the rest.

The figures in the right hand margin indicate marks.

Q1 **Answer the following questions:** (2 x 10)

a) What do you mean by *local maximum* and *global maximum*?
b) State three different types of structural optimization problems.
c) Determine whether the following function is convex or concave. $f(x)= 5x^2$.
d) Distinguish between *linear* and *nonlinear* optimization problem.
e) What do you mean by a constrained optimization problem?
f) An optimization problem becomes nonlinear if either objective function or constraints are nonlinear. Explain, if the statement is true or false.
g) Define inflection point. Draw a figure to show this point in a curve.
h) In the NLP, the variables are integer or real? Explain.
i) State the difference between TP and AP.
j) What do you mean by degeneracy in a TP?

Q2 a) State Lagrangian method to find an optimum of a function of *n* variables subject to *m* (*m*≤*n*) constraints. (5)

b) Find the maximum or minimum of the function (5)
$F(X)=x_1^2+x_2^2+x_3^2- 5x_1-8x_2-14x_3+ 60.$

Q3 Use the Wolfe's method to solve the given quadratic programming problem. (10)
Maximize $Z=2x_1+x_2-x_1^2$
Subject to i) $2x_1+3x_2\leq 6$; ii) $2x_1+x_2\leq 4$ and $x_1, x_2\geq 0$

Q4 Use two iterations of Newton Raphson method to minimize the following function. (10)

$$f(x) = 2\exp(x) - x^3 - 10x$$

Q5 a) With a flownet, explain the development of an optimization problem of a simply supported beam with a concentrated load at the centre. (5)

b) For the following function, use two iterations of Fibonacci method in the interval (0,3) (5)

$$f(x) = x^3 - 2x + 10x$$

Q6 Solve the LPP BY KUHN TUCKER CONDITIONS (10)

Maximize $Z = -(x_1)^2 - (x_2)^2 - (x_3)^2 + 4x_1 + 6$

Subject to the constraints:

$$x_1 + x_2 \leq 2$$
$$2x_1 + 3x_2 \leq 12$$
$$x_1, x_2 \geq 0$$

Q7 a) A beam of uniform rectangular cross section is to be cut from a log having a circular cross section of radius, R. The beam is to be used as a cantilever beam (the length is fixed) to carry a concentrated load, W at the free end. Find the dimension of the beam that carry a load, which corresponds to maximum tensile (bending) stress carrying capacity. (10)

Q8 Write short notes on any **TWO** (5 x 2)

a) Classical optimization
b) Formulation of optimization problem
c) Lagrange multiplier technique
d) Linear programming problems.