FACULTY OF ENGINEERING
DEPARTMENT OF CIVIL ENGINEERING
FIRST SEMESTER EXAMINATION (MARCH 2018)
2017/2018 ACADEMIC SESSION

HOD'S SIGNATURE

Instructions:

1) Answer 5 questions in full-3 questions from part A and 2 questions from B
2) **Time Allowed:** 3 Hours
3) **SEVERE PENALTIES APPLY FOR MISCONDUCT, CHEATING, POSSESSION OF UNAUTHORIZED MATERIALS DURING EXAMINATION**

Course Title: **CIVIL ENGINEERING AND SYSTEMS ANALYSIS AND DESIGN**

Course Code: **CVE 531**

ELIZADE UNIVERSITY ILARA-MOKIN
DEPARTMENT OF CIVIL ENGINEERING
Second Semester 2017/2018 Session
CVE 531: CIVIL ENGINEERING AND SYSTEMS ANALYSIS AND DESIGN
Time Allowed: 3HOURS
Instruction: Answer 5 questions in full-3 questions from part A and 2 questions from B

PART ONE

Question 1 (20 marks)

a) Describe 'project' and list the different phases of a typical civil engineering project. (10marks)

b) What are the various form of a construction project usually available to a civil engineering project management? (5 marks)

c) Describe briefly the role of each construction team for a civil engineering project. (5 marks)

Question 2 (20 marks)

a) What is meant by time value of money when dealing with project cost and analysis? (5 marks)

b) Define the following terms related to time value of money

i. Interest
ii. Interest Rate
iii. Equivalence
iv. Present Worth
v. Annual Worth (15 marks)

Question 3 (20 marks)

a) For a civil engineering project, if an amount R naira is invested for years at an interest rate (i), to yield a future sum (S), show that: (10 marks)

$$R = S\left[\frac{i}{(i+1)^n - 1}\right]$$

b) From (a) above, show that the uniform end of the year payments R which can be secured for n years from a present investment (p), at interest rate (i). is

$$R = P\left[\frac{i(1+i)^n}{(1+i)^n - 1}\right] = \left[i + \frac{i}{(i+1)^n - 1}\right]$$

Question 4 (20 marks)

a) Define or briefly outline the following concept:

i. Systems

ii. Systems analysis

iii. System design

iv. Civil engineering systems

v. Optimization (10 marks)

b) Outline 5 examples of civil engineering systems, indicating how each can be regarded as a system. (10 marks)

Question 5 (20 marks)

a) Define linear programming as an optimization technique, writing a mathematical LP model with the description of terms or variables used. (5 marks)

b) What are conditions that must be satisfied to be able to use LP to solve optimization problems? (5 marks)

c) Outline 5 practical applications of linear programming. (5 marks)

PART B

Question 6 (20 marks)

Solve the following problems by LP techniques, assuming all x_i to be non-negative

a) Maximize $Z = 30x_1 + 20x_2$

Subject to: $-x_1 + x_2 \leq 5$

$2x_1 + x_2 \leq 10$ (5 marks)

b) Minimize $Z = 5x_1 - 20x_2$

Subject to: $-2x_1 + 10x_2 \leq 5$

$2x_1 + 5x_2 \leq 10$ (5 marks)

(c) Maximize the daily output in producing x_1 chairs by process P_1 and x_2 chairs by process P_2 subject to

$3x_1 + 4x_2 \leq 550$ (machine hours)

$5x_1 + 4x_2 \leq 650$ (labour hours)

5mrks

(d) Maximize the daily profit in producing x_1 metal frames F1 (profit ₦ 900 per frame) and x_2 frame F2 (profit ₦ 500 per frame)

$X_1 + 3x_2 \leq 18$ (materials)

$X_1 + x_2 \leq 10$ (machine hours)

$3x_1 + x_2 \leq 24$ (5 marks)

Question 7 (20 marks)

a) State the conditions for the existence of maxima and minima for function with two variables. (10 marks)

b) The profit (z) of a firm depends upon the level of output (Q) and the advertising expenditure (A). Assuming the second order derivative conditions are satisfied. find the profit maximizing values of Q given the following relationship $Z = 800 - 3Q^2 - 4Q + 2QA - 5A^2 + 48A$. What is the maximum profit? (10 marks)

Question 8 (20 marks)

Design an optimum trapezoidal canal to convey water for which the cross-sectional area A $10m^2$. (note that the mean velocity increases with hydraulic radius $R = \frac{A}{P}$, where P is the wetted perimeter. The discharge is maximum; hence the design optimization reduces to maximizing the wetted perimeter).

Question 9 (20 marks)

a) A young engineer has estimated that his earnings should average ₦ 600,000, ₦ 1,000,000 and ₦ 1,500,000 per year in succeeding decades from the time he takes his first job after graduation. Allow 3 percent interest compounded annually each for cost of money and return. Determine

i. Present worth (at graduation) in cash of the 30years earnings.

ii. Equivalent uniform annual value of the 30years estimated income. (10 marks)

b) Determine the total amount of money that an engineer must pay on the day his son is born, into an account bearing an interest of 5% to be compounded annually in order provide payment of ₦ 20,000 on each of the son's 18^{th}, 20^{th} and 21^{th} birthdays. Determine the equivalent worth of the four ₦ 20,000 payments as of the son's 24^{th} birthdays. (10 marks)