NATIONAL OPEN UNIVERSITY OF NIGERIA
PLOT 91, CADASTRAL ZONE, NNAMDI AZIKIWE EXPRESSWAY, JABI - ABUJA
FACULTY OF SCIENCE
OCTOBER/NOVEMBER 2016 EXAMINATION

COURSE CODE: **CIT756**

COURSE TITLE: **OPERATIONS RESEARCH**

CREDIT UNITS: **3**

TIME ALLOTED: **2 HOURS**

INSTRUCTION: ***Answer any FOUR questions. Cordless nonprogrammable calculators may be used.***

1.
   a. Briefly explain the concept of Operations Research. *(4.5 marks)*
   b. Mention the main limitations of Operations Research. *(6 marks)*
   c. Briefly explain why digital computers are vital in operations research. *(7 marks)*

2.
   a. Distinguish between a simulation and an iconic model *(4 marks)*
   b. Write short notes on
      i. probabilistic and
      ii. deterministic models. *(8 marks)*
   c. Briefly describe the salient features of a dynamic model. *(5.5 marks)*

3.
   a. A linear programming problem is paused as follows: Find the values of $y_1$and y_2 that will minimize the sum y_1+3y_2 subject to the following constraints:

      $$y_1+2y_2 \geq 32 \quad y_1+y_2 \geq 5 \quad y_1 \geq 0$$

      Using a graphical method or otherwise solve the problem. *(13.5 marks)*

   b. Briefly describe 4 classes of mathematical models. (*4 marks*)

4.
   a. Briefly define Linear Programming and mention five major assumptions made in applying it. (7 *marks*)

b. Describe Vogel's Approximation Method and describe its algorithm. (6 *marks*)

c. Briefly explain the concept of Optimality. *(4.5 marks*)

5.

a. Briefly describe three approaches in the analysis and interpretation of a business problem.
(*4.5 marks*)

b. A fertilizer manufacturer has three plants (one each in Calabar, Bauchi and Ibadan) and distributes the product to four warehouses (one each in Benin, Sokoto, Gombe and Abuja). The capacity of the plants and the demands of the warehouse are stable and have values as shown in the following table. The unit shipping costs are also indicated in the intersection squares of the table. Determine an optimal distribution plan for the company.

PLANTS	WAREHOUSES				**MONTHLY CAPACITY**
	BENIN	SOKOTO	GOMBE	ABUJA	
CALABAR	10	16	14	12	**50**
BAUCHI	12	10	5	10	**40**
IBADAN	10	14	12	10	**80**
MONTHLY DEMANDS	**35**	**30**	**45**	**50**	~~170~~ 160

(13 marks)

6.

a. Write down three basic characteristics of a queuing system.
(*4.5 marks*)

b. The marketing department has collected data regarding the deployment of salespersons and sales made in three zones of its target market. There is evidence that sales are directly dependent on the number of salespersons in each zone as indicated by the collected data shown in the table below. If the company has decided to retain 9 salespersons during next year determine the allocation plan for these salespersons to the three zones so as to maximize sales.

NO. OF SALESPERSONS	PROFITS IN THOUSANDS OF NAIRA		
	ZONE 1	ZONE2	ZONE3
0	30	35	40
1	35	45	45
2	40	60	55
3	55	70	65
4	65	80	75
5	75	90	85
6	85	95	95
7	100	100	105
8	95	95	115
9	85	100	95

(*13 marks*)