NATIONAL UNIVERSITY OF SCIENCE AND TECHNOLOGY

FACULTY OF INDUSTRIAL TECHNOLOGY

DEPARTMENT OF INDUSTRIAL AND MANUFACTURING ENGINEERING

Bachelor of Engineering Honours Degree Industrial and Manufacturing Engineering

2nd Semester Main Examination

COURSE : **OPERATIONS RESEARCH**

CODE : **TIE 5208**

DATE : **MAY 2014**

DURATION : **3 HOURS**

INSTRUCTIONS AND INFORMATION FOR THE CANDIDATE

1. Answer any FIVE **(5)** questions.
2. Each question carries 20 marks.
3. This paper contains SEVEN**(7)** questions.
4. There are FOUR **(4)** printed pages.

QUESTION 1.

(a) Even though independent fuel stations have been having a difficult time, Eng. Kasango has been thinking about starting his own independent fuel station. Eng. Kasango's problem is to decide how large his station should be. The annual returns will depend on both the size of his station and a number of marketing factors related to the oil industry and demand for fuel. After a careful analysis, Eng. Kasango developed what is shown in Table Q1. Below.

Table Q1. Initial Decision Table

Size of First Station	Good Market ($)	Fair Market ($)	Poor Market ($)
Small	50,000	20,000	-10,000
Medium	80,000	30,000	-20,000
Large	100,000	30,000	-40,000
Very Large	300,000	25,000	-160,000

For Example, if Eng Kasango constructs a small station and the market is good, he will realize a profit of $50,000.

(i) Develop a decision table for this decision [9]
(ii) What is the maximax decision? [1]
(iii) What is the maximin decision? [1]
(iv) What is the equally likely decision? [1]

(b) Using data in Question 1(a), develop a decision tree and determine the best decision based on the highest expected monetary value. Assume each outcome is equally likely. [8]

QUESTION 2.

(a) Explain how Operations Work differs from Project Work [6]
(b) Discuss the principle of the Project Management Triangle [6]
(c) You are tasked to organize and train five teams of field engineers for a big project. The main activities identified for this project are indicated in Table Q2 below.

Table Q2. Activities and their precendence relationships

Activity	Immediate Predecessor	Duration (Days)
A. Indentify engineers and their scheduled	-	5
B. Arrange transport to base	-	7
C. Identify and collect training material	-	5
D. Arrange accommodation	A	3
E. Identify team	A	7
F. Bring in team	B,E	2
G. Transport engineers to base	A,B	3
H. Print Program Material	C	10

I. Have program material delivered	H	7
J. Conduct training program	D,F,G,I	15
K. Perform fieldwork training	J	30

Prepare a network diagram and define the critical path. [8]

QUESTION 3.

A large oil company operating a number of drilling platforms in the North Sea is forming a high speed rescue unit to cope with emergency situations which may occur. The rescue unit comprises 6 personnel who, for reasons of flexibility, undergo the same comprehensive training program. The six personnel are assessed as to their suitability for various specialist tasks and the marks they receive in the training program are given in Table Q3.

Table Q3 . Marks obtained per individual

	Trainee No.					
Specialist Task	I	II	III	IV	V	VI
Unit leader	21	5	21	15	15	28
Helicopter Pilot	30	11	16	8	16	4
First Aid	28	2	11	16	25	25
Drilling Technology	19	16	17	15	19	8
Fire Fighting	26	21	22	28	29	24
Communications	3	21	21	11	26	26

Based on the marks awarded, what role should each of the trainees be given in the rescue unit? [20]

QUESTION 4.

(a) Explain how the periodic review system of stock control works. [4]
(b) Discuss the 4 major categories of inventory costs that would be found in a large engineering company. [16]

QUESTION 5.

(a) Using an example of your choice, explain how Data Mining can be used as an Operations Research tool. [4]
(b) Explain how models can assist a manager in decision making. [4]
(c) Discuss the advantages and limitations of models in decision making [12]

QUESTION 6.

An organization has four destinations and three sources for supply of goods. The transportation cost per unit is given in Table Q6 below.

Table Q6. Transportation cost per unit

Destination						
		D1	**D2**	**D3**	**D4**	Availability (Supply)
Source	**S1**	13	16	19	17	250
	S2	17	19	16	15	200
	S3	15	17	17	16	250
	Requirement (Demand)	**100**	**150**	**250**	**100**	

(a) Decide the optimal transportation scheme for this case. [15]
(b) Calculate the cost of this optimal scheme [5]

QUESTION 7.

(a) What are the key characteristics of Linear Programming problems. [5]
(b) A farmer in Nyamandlovu has 900 acres of land. She is going to plant each acre with corn, soya beans, or wheat. Each acre planted with corn yields a $2,000 profit; each with soyabeans yields $2,500 profit; and each with wheat yields $3,000 profit. She has 100 workers and 150 tons of fertilizer. Table Q7 shows the requirement per acre of each of the crops.

Table Q7

	Corn	**Soyabeans**	**Wheat**
Labour (workers)	0.1	0.3	0.2
Fertilizer (tons)	0.2	0.1	0.4

Determine the optimal planting mix of corn, soyabeans and wheat to maximize her profits. [15]

END OF EXAMINATION