NATIONAL UNIVERSITY OF SCIENCE AND TECHNOLOGY

FACULTY OF INDUSTRIAL TECHNOLOGY

DEPARTMENT OF INDUSTRIAL AND MANUFACTURING ENGINEERING

Bachelor of Engineering Honours Degree Industrial & Manufacturing Engineering

OPERATIONS RESEARCH – TIE 5208

2nd SEMESTER EXAMINATIONS AUGUST 2009

Instructions to Candidates
1. Time allowed 3 hours
2. Answer any four Questions of six
3. Each question carries 25 Marks.

QUESTION 1

A firm has 3 shops with a total of 80 televisions. An order is received from the Local Authority for 70 sets to be delivered to 4 schools. The transport cost from shops to schools are shown below together with the availabilities and requirements.

	Sets Available	A 20	B 30	C 15	D 5	Requirements
Shop I	40	2	4	1	6	
Shop II	20	4	3	3	3	Costs
Shop III	20	1	2	5	2	

a) Set out the procedure to make the most economic deliveries of television sets from shops to schools.   [15]
b) Calculate the total cost of this delivery schedule   [4]
c) What other situations should be considered for making a decision after finding the optimum solution using the method in (a) above   [6]

QUESTION 2

(a) How does the role of a project manager differ from that of a traditional functional manager?   [4]
b) "Project control should always focus on the critical path" Comment?   [3]

c) A company manufactures electric power-generating systems for the major electric power companies.Turbine/generator sets are made to specific order and generally requires a 3-5 lead-time. Costs range from $8m-$15m per set.

Management has been planning their production using traditional planning techniques such as planning charts, gantt charts, and other shop floor control methods. However, management would like to introduce CPM project planning and control methods where each turbine/generator is considered a separate project. PF is a segment of the total activities involved in the turbine/generator production.

Table 2.1: Activity relationship and duration.

Activity	Immediate Predecessors	Time (weeks)
A	-	8
B	A	16
C	A	12
D	A	7
E	B,C	22
F	C,D	40
G	E.F	15
H	-	14
I	H	9
J	I	13
K	I	7
L	J	36
M	K	40
N	L,M	9
O	G,M	10

i)   Draw the network diagram   [10]
ii) Find the critical path   [2]
iii) Which activities would one decrease to cut the project time by 2 weeks?   [3]
iv) Which activities would one decrease to cut the project time by 10 weeks?   [3]

QUESTION 3

a) You are the Chief Engineer of a company and you have four field engineers reporting to you. You need your engineers to deal with the jobs in the table 3.1 The times for each job are estimated as follows:

Table 3.1: Times for Jobs.

	Albert	Benard	Charlie	Danniel
	Service Engineer			
Job 1	6	12	20	12
2	22	18	15	20
3	12	16	18	15
4	16	8	12	20
5	18	14	10	17

i)   Allocate the service engineers to the jobs so as to minimise the total time taken and identify the job which will not be dealt with   [15]

ii)   How does the solution method for maximising problems differ from minimising problems in the assignment method?   [4]

b) Define the following terms in relation to Operation Research (OR)
   i) Optimal solution   [2]
   ii) Mathematical Modelling   [2]
   iii) Probability   [2]

QUESTION 4

a) What general class of management problems is linear programming appropriate for And give 2 examples of linear programming applications   [5]

b) What is the purpose and meaning of "Slack variables"   [2]

c) A laboratory with more requests than it can handle specialises in two types of tests, X and Y, and would like to determine how many of each to perform each week to maximise its revenue. Each week the lab can use up to 240 technician–hours, 100 inspector- hours,and 40 testing-equipment hours. Ttest X requires 4 technician-hours, 1 inspector–hour and no equipment time. Test Y requires 2 technician–hours 2 inspector-hours, and 1 machine-hour. The unit profit contributions are $20 for test X and $30 for test Y.

   i)   Identify the decision variables and state the objective function and constraints for the problem   [6]

   ii)   Using the graphical method, determine the optimal solution   [4]

   iii)   Solve the problem using the Simplex Method.   [8]

QUESTION 5

a)   How can the Pareto Analysis be used for effective stock control.?   [3]

b)   Discuss the various reasons for holding stock.   [10]

d)   Describe how the following stock control methods work.
   i)   Re-order level system .   [3]
   ii)   Periodic review system.   [3]

d)   Discuss the relationships between all the costs associated with stock.   [6]

QUESTION 6

a)   Define the following terms
      i)   Operations Research (OR)   [2]
      ii)   Linear programming   [2]

b)   How do the following OR methods work?
      i)   Neural Networks   [2]
      ii)   Patten recognition   [2]
      iii)   Visualisation   [2]

c)   "Model Validation" is the forth phase in Operations Research.
    Explain what it is and its importance.   [10]

d)   What are the advantages and disadvantages of the "Team concept approach" in
    Operations Research.   [5]

END OF EXAM