FNU FIJI NATIONAL UNIVERSITY

College of Engineering, Science and Technology (CEST)
School of Electrical & Electronic Engineering

ADVANCED DIPLOMA IN ENGINEERING AND BACHELOR OF ENGINEERING (ELECTRICAL & ELECTRONICS) YEAR 2

EEE601 – ENGINEERING PLANNING

FINAL EXAMINATION - SEMESTER 1

DAY/DATE: MONDAY - JUNE 5TH, 2017. TIME: 9.00am - 12:10pm.

INSTRUCTIONS TO STUDENTS:

1. You are allowed 10 minutes Extra reading time during which you are NOT to write.
2. Begin each Section on a fresh page and use both sides of the sheet.
3. Write your candidate – number at the top of each attached sheet.
4. Insert all written foolscaps, graph paper, drawing paper, etc. in their correct sequence and secure with string.
5. For all sheets of paper on which rough/draft work has been done, cross it through and ATTACH to your answer scripts.
6. Write clearly the number(s) of the question(s) attempted on the top of each sheet.
7. There are TWO (2) parts to this examination.
8. Question 1 is COMPULSORY
9. You are to answer ONLY THREE (3) more questions from the remaining questions.
10. THIS IS AN OPEN BOOK EXAMINATION AND YOU ARE ALLOWED TO BRING INTO THE EXAMINATION ROOM MATERIALS THAT ARE USEFUL TO THIS EXAM.
11. CANDIDATES ARE NOT ALLOWED TO EXCHANGE NOTES OR MATERIALS DURING THE COURSE OF THIS EXAMINATION.

EEE601 ENGINEERING PLANNING JUNE 2017

QUESTION 1 **(40 marks total)**

This question is compulsory. All candidates must attempt this question.

(i) A project involves eight (8) activities identified by the code letters given on the table 1a below.
Table below identifies the order in which the activities must be undertaken.
Create a network for the project. (4 marks)

Activity	Code Letter of Any Immediately Preceding Activity or Activities
I	-
II	-
III	II
IV	-
V	I
VI	I, III, IV
VII	I, III, IV
VIII	VI, VII

Table 1a.

A CPA network for another different project is drawn below, Figure 1a. Activity times, in days, are indicated by the numbers that appears under each activity arrow.

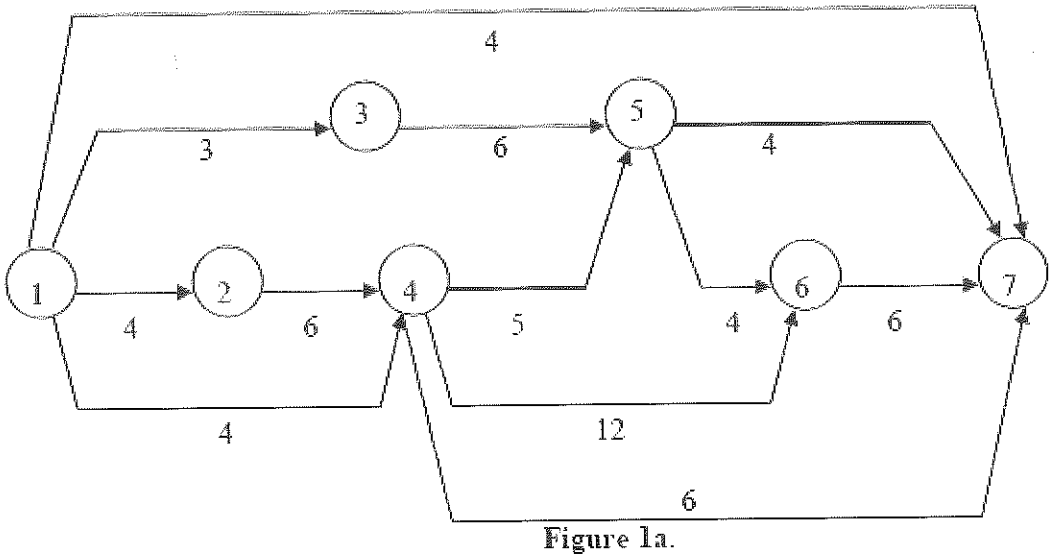

Figure 1a.

(ii) Analyse the network and find the earliest and latest event times, and the duration of the project.

(10 marks)

(iii) What are the earliest and latest start and finish times, and values of total, free and independent float for activity 3-5?

(3 marks)

The number of employees required for each activity involved in the project, is shown in the following table 1b. The duration of individual activities cannot be altered by the allocation of additional eployees, nor may activities be divided into smaller components performed at different times.

Activity	Employees Required Per Day
1-2	4
1-3	3
1-4	6
1-7	2
2-4	7
3-5	3
4-5	5
4-6	5
4-7	6
5-6	2
5-7	1
6-7	4

Table 1b.

(iv) Plot a sequenced bar chart, not a Gantt chart, for the project with all activities at their earliest start times. What is the maximum number of people required on any single day of the project?

(7 marks)

(v) By utilising the floats in the various activities, smooth the daily requirement for people as much as possible. Redraw the bar chart after smoothing. What is the minimum ceiling of people required per day to complete the project in minimum time?

(6 marks)

(vi) Another network , Figure 1c, for a project is shown below. Activity times, in days, are indicated by the figure that appears under each activity.

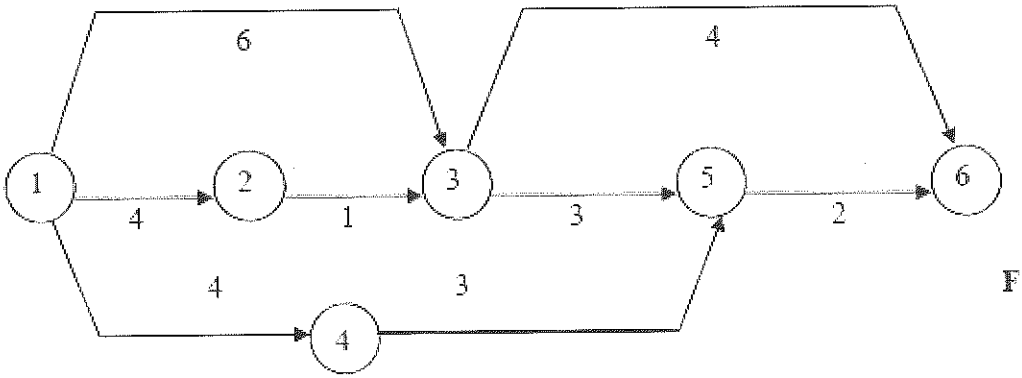

Figure1c.

Using the cost data in the table below, Table1c, indicate what activities should be crashed and to what extent, if the project duration must be reduced by three (3) days at minimum cost.

What is the total additional cost involved in crashing the project by three days?

(10 marks)

Table1c.

Activity	Normal		Crashed	
	Duration (Days)	Cost ($)	Duration (Days)	Cost ($)
1-2	4	400	2	460
1-3	6	500	2	700
1-4	4	300	2	460
2-3	1	400	1	400
3-5	3	350	2	450
3-6	4	260	2	300
4-5	3	500	2	700
5-6	2	300	1	450
	Total	**3010**		

ATTEMPT THREE (3) OF THE FOLLOWING QUESTIONS

QUESTION 2 (20 marks total)

(i) An industrial company is able to produce a certain component by either a die casting process or a machining operation. Given the information in Table 2, which of these processes would be more economical for the manufacture of 6,000 such items? (Illustrate your answer by showing the total production costs for 6,000 items, for each process: the general overheads includes machine depreciation).

(12 marks)

Table 2

	Die casting	Machining
Tool cost	$10,000	$1,000
Tool settlers' rate per hour	$12.00	$12.00
Set up time	6 hours	3 hours
General overheads per hour	$10	$8
Direct material cost per item	$0.30	$0.80
Operators' wage per hour	$2.00	$8.00
Time to produce one item	18 seconds	3 minutes

(ii) What is the minimum number of components that must be produced before the die casting process is more economical? (4 marks)

(iii) If the selling price is $1.80 per item, what is the profit made if 10,000 items were sold? (4 marks)

QUESTION 3 (20 marks total)

Selbourne Electronics is a relatively new firm making small calculators. Selbourne entered the business with the production of an inexpensive handheld calculator, the ZX-100, which sells for $15. It has recently added a more powerful version of the ZX-100 called the ZX-200. The ZX-200 sells for $25.

The variable costs of producing a ZX-1000 and a ZX-2000 are given in Table 3.

Table 3

	ZX-100	ZX-200
Labour	$3.00	$5.00
Material	$6.00	$12.00
Factory overhead	$2.00	$2.00
Total	$11.00	$19.00

Selbourne produces its own circuit boards and purchases all other materials from other firms. Manufacturing of circuit boards is a complex operation, which requires precision equipment. Selbourne has the capacity to produce, at most, 61,000 basic circuit boards per month. One of these circuit boards is used in each ZX-100 calculator. To manufacture the advanced circuit board for the ZX-200 calculator takes three times as long on this precision equipment as the ZX-100. Therefore, if Selbourne made no basic circuits at all, it could produce no more than 20,333 (i.e. 61,000/3) of the ZX-200 boards. Selbourne can manufacture any combination of ZX-100 and ZX-200 circuit boards, as long as the combined production time does not exceed the available capacity.

Assembly time for the two calculators is:

- ZX-100: 0.2 hour
- ZX-200: 0.25 hour

If the company maintains its current two-shift operation, it has available 8000 hours of assembly time per month.

The marketing manager has undertaken a detailed study of the calculator market and foresees a monthly demand of 40,000 units for ZX-100 calculator and 18,000 units for ZX-200.

If Selbourne would like to maximise its profit, how many ZX-100 and ZX-200 calculators should it produce?

(You may use graphs to solve the problem and use the graph page available or otherwise).

QUESTION 4 (20 marks)

(i) Determine the minimum cost of completing the project in figure 4 within the shortest possible duration. Time/cost data for the project is shown in table 4.

(ii) If indirect costs are $100 per day, draw a graph showing direct, indirect and total costs for the project.

Determine the most economic CP time from your graph.

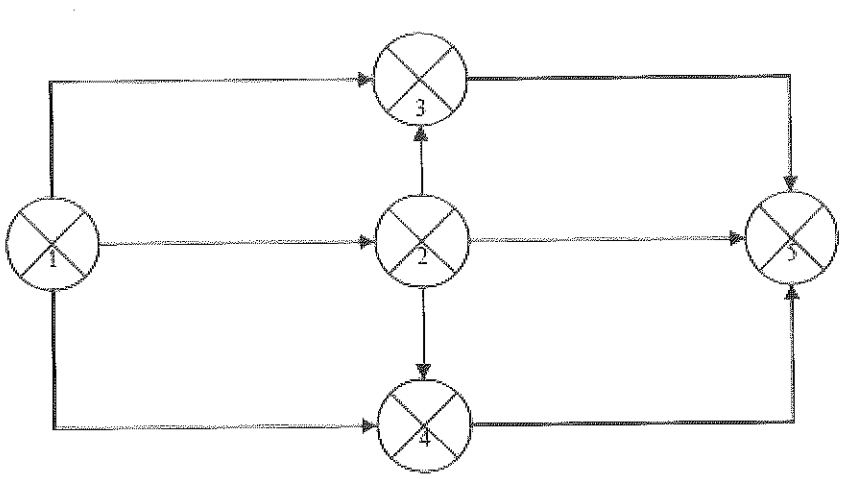

Figure 4

Table 4

Activity	Normal Time	Normal Cost $	Crash Time	Crash Cost $
1 - 2	3	140	2	210
1 - 3	6	215	5	275
1 - 4	2	160	1	240
2 - 3	4	130	3	180
2 - 4	2	170	1	250
2 - 5	7	165	6	205
3 - 5	4	210	3	290
4 - 5	3	110	2	160

QUESTION 5 (20 marks)

Sanzoy Fitler, director of the personnel management firm of Staff Research Pty Ltd designed a CPA program for their customers to use in the job finding process. He listed the activities which include such things as preparing resumes, writing letters, advertising, arranging interviews, interviewing, research into companies and industries, etc. The activities he considers may be necessary together with their probabilistic times (days) and their logical sequence are listed in the following table, Table 5.

Table 5

Activity	Immediate Predecessor/s	days			Expected Time	Variance
		a	m	b		
A	-	8	10	12		
B	-	6	7	9		
C	-	3	3	4		
D	A	10	20	30		
E	C	6	7	8		
F	B, D, E	9	10	11		
G	B, D, E	6	7	10		
H	F	14	15	16		
I	F	10	11	13		
J	G, H	6	7	8		
K	I, J	4	7	8		
L	G, H	1	2	4		

(i) Complete the table by inserting values for the expected time and the variance of each activity. (4 marks)

(ii) Construct a CPA network for the activities listed using the expected completion time and clearly mark the Critical Path. (10 marks)

(iii) Determine the probability that the project can be completed in:

(a) 70 days
(b) 80 days
(c) 90 days (6 marks)

The End