UNIVERSITY OF RUHUNA

Faculty of Engineering

Mid-Semester 8 Examination in Engineering: October 2015

Module Number: CE8328 **Module Name: Construction Management**

[Two Hours]

[Answer **all questions**, each question carries five marks]

Q1.

a) Taking an infrastructure project as example, explain its project life cycle (You may assume a hypothetical or a real project).

[2.0 Marks]

b) Explain the level of effort that should be exerted by the project team during different stages of the project life cycle.

[1.0 Mark]

c) Explain the general nature of the construction industry taking four characteristics.

[2.0 Marks]

Q2.

a) What are the steps to be followed in preparing a "Network Diagram"?

[1.0 Mark]

b) Explain the situations where "identity dummy" and "logic dummy" have to be included in an Arrow Network Diagram.

[1.0 Mark]

c) Table Q2 represents the details of a construction project. Draw the network diagram using Precedence Diagram Method to represent these details.

[1.5 Marks]

d) Analyze the network from (c) to calculate early start time, early finish time, late start time, late finish time and total float of activities.

[1.5 Marks]

Q3. A company is awarded a contract to construct a building. Construction plan for this project was prepared and it is shown in Figure Q3 (a). Corresponding bar chart is shown in Figure Q3 (b). Two resource requirements (labours and cranes) for this project were estimated and it is given in Table Q3. Company is planning to use in-house labours with maximum capacity 100 and without frequent fluctuation of labour demand. One crane will be taken on hired basis whenever necessary.

a) Draw the resource histograms for the given two resource categories.

[2.0 Marks]

b) Explain the following factors for the drawn two resource histograms in part (a).

i Is it always possible to provide the required resources?

ii Is it always necessary to provide the required resources?

iii Is it practical to provide resources as indicated by a normal histogram?

[3.0 Marks]

Q4.

a) Explain with an example, the occasions where Line of Balance (LOB) planning technique can be used.

[1.0 Mark]

b) What is the importance of introducing a buffer time when preparing a LOB schedule?

[1.0 Mark]

c) Figure Q4 shows a construction plan where Line of Balance (LOB) schedule is to be prepared. Table Q4 (a) gives other planning data for the LOB schedule. Buffer time is taken as two days.

i Draw the LOB diagram to represent the information available in Figure Q4 and Table Q4 (a) (Use the graph sheet provided).

i Prepare a schedule to show the required information in Table Q4 (b).

ii If the client wants to get 15 units fully completed at the end of day 110, what are the activities that have to be changed? Show the necessary changes on the same plot drawn in above part (i).

[3.0 Marks]

Table Q2: Details of activities, durations and relationships

Activity	Predecessor	Duration (Days)
A	At project start	12
B	At project start	7
C	Can start after 3 days of A starts	6
D	Can start after A finish	8
E	Can start after both B and C finish	10
F	Can start after 2 days of E finishes and can finish with finish of D	5
G	Can start 1 day before F finish	9
H	Can start with G starts	15
I	Can start after G finish and can finish with finish of H	12
J	Can start 5 days after E starts	6
K	Can start after both I and J finish	3

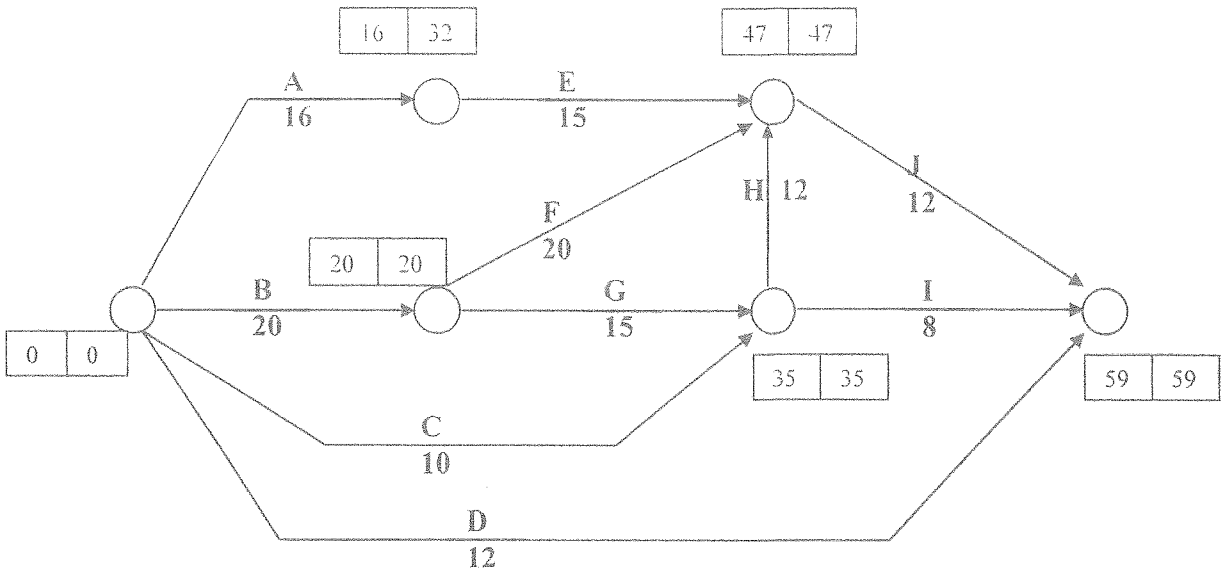

Figure Q3 (a): Network Diagram for the Project

Activity	Duration	Men	Cranes	10	20	30	40	50	60
A	16	30	-						
B	20	60	1						
C	10	9	-						
D	12	40	-						
E	15	30	-						
F	20	10	-						
G	15	60	1						
H	12	40	1						
I	8	40	1						
J	12	50	-						

Figure Q3 (b): Bar Chart for the Project

Table Q3: Resource Requirements

Activity	Resources	
	Men	Crane
A	20	-
B	60	1
C	9	-
D	40	-
E	30	-
F	10	-
G	60	1
H	40	1
I	40	1
J	50	-

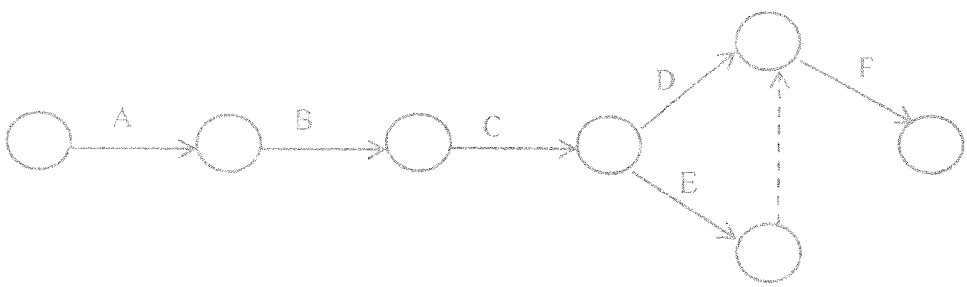

Figure Q4: Network Diagram for the LOB Schedule

Table Q4 (a): Information for the LOB Schedule

Operation	Natural rate of build	Time per operation	Elapsed time between 1st & last unit
A	2.42	5	72
B	1.92	4	91
C	1.44	5	121
D	1.60	4	109
E	2.12	4	83
F	3.85	2	46

Table Q4 (b): Schedule Prepared from LOB Schedule

Unit Number	Starting time	Finishing time
5		
10		
15		
20		
25		
30		

a.) For sea-level atmospheric conditions; use followings:

Static pressure (P_0)	=	101325 Pa
Temperature (T_0)	=	288.15 K
Density (ρ_0)	=	1.225 kg.m^{-3}
Acceleration due to gravity (g_0)	=	9.81 m.s^{-2}
Specific heat ratio (γ)	=	1.4
Real gas constant (R_g)	=	287 J.kg^{-1}.K^{-1}

b.) In an ISA, the static pressure (*P*) and the temperature (*T*) are given by,

Below 11 km;

$$P = P_0\left(1 - 2.2558\times10^{-5}h\right)^{5.2559} \text{ N.m}^{-2},$$

$$T = T_0 - 0.0065h \text{ K.}$$

From 11 km to 20 km;

$$T = Const.$$

$$\ln\frac{P}{P_b} = -\frac{g_0}{RT_b}\left(H - H_b\right)$$

Where *h* is measured in meters, note 1 ft = 0.3048 m.

c.) For a steady, adiabatic, isentropic and inviscid flow, the total pressure (P_T), free stream pressure (P_∞) and free stream Mach number (M_∞) are related as,

$$P_T = P_\infty\left[1 + \frac{\gamma-1}{2}M_\infty^2\right]^{\frac{\gamma}{\gamma-1}}$$

d.) Atmospheric air can be treated as a perfect gas,

$$P = \rho R_g T$$

Speed of sound $a = \sqrt{\gamma R_g T}$.

Section B

Q1. a) State cockpit control commands for following flight maneuvers.

i. Yaw to the left,

ii. Pitching down,

iii. Acceleration of the aircraft.

[1.5 Marks]

b) Derive an expression for lift coefficient and drag coefficient in terms of normal force coefficient and axial force coefficient for flow over an airfoil.

[0.5 Marks]

c) The normal force coefficient and axial force coefficient in relation to an airfoil with usual notations can be expressed as:

$$c_n = \frac{1}{c}\left[\int_0^c (C_{p,l} - C_{p,u})\,dx + \int_0^c \left(c_{f,u}\frac{dy_u}{dx} + c_{f,l}\frac{dy_l}{dx}\right)dx\right]$$

$$c_a = \frac{1}{c}\left[\int_0^c \left(C_{p,u}\frac{dy_u}{dx} - C_{p,l}\frac{dy_l}{dx}\right)dx + \int_0^c (c_{f,u} + c_{f,l})dx\right]$$

Hence, for an incompressible and inviscid flow, deduce an expressions for c_l and c_d in terms of Cp.

[2.0 Marks]

d) Draw the Cp variations along the chord length for the following cases;

i) Symmetric airfoil at zero angle of attack.

ii) Cambered airfoil at zero angle of attack.

[1.0 Marks]

Q2. a) How to make two dimensional flow over a finite wing?

[0.5 Marks]

b) Explain: "Appropriate gaps have to be maintained between consecutive take-offs in an airport".

[1.0 Marks]

c) Describe how the induced drag is generated in a finite wing.

[1.0 Marks]

d) An airplane is cruising at a velocity of 875 km/h at a pressure altitude of 8,975 m. The mass, wing span and the wings planform (in elliptic form) area of the plane are 5850 kg, 10.5 m and 28.5 m^2, respectively. The profile drag coefficient at the cruise is 0.008. Calculate the followings during the cruise.

i) Lift coefficient.

ii) Induced drag coefficient.

iii) Power required by the aircraft.

[2.5 Marks]