



UNIVERSITY OF RUHUNA

Faculty of Engineering

Mid-Semester 6 Examination in Engineering: November 2014

Module Number: CE6320

Module Name: Building Engineering

[Two Hours]

[Answer all questions, each question carries five marks]

Refer to City of Colombo Development Plan when answering for Q1 and Q2

- Q1. a) Chathura Engineering Consultancy Services is under-taking property development and building planning works. Company wants to recruit a qualified person to the company. What are the required qualification to be recruited as a qualified person in the context of planning and building regulations? [2.0 Marks]
- b) Explain duties of qualified person employed or engaged to prepare the plans or to supervise building work and other development activities. [2.0 Marks]
- c) What are the occasions that can be considered as offences made by qualified person related to building and planning work? [1.0 Mark]
- Q2. Assume that you are employed in a company undertaking land and housing development projects. The company has given an assignment to prepare a land sub-division plan for residential purpose. Company's requirements regarding extend of lots are as follows.
- Minimum five lots with land area between eight panch (8.0 p) to ten panch (10.0 p) and those should be away from the main road.
 - Minimum four lots with more than fifteen panch (15.0 p) but less than twenty panch (20.0 p) and those should be closer to the main road.
 - Few number of lots having land area between ten panch (10.0 p) to fifteen panch (15.0 p).
 - The land for proposed sub-division is shown in Figure Q2.
- a) Sketch the sub-divided land according to the company's requirements and planning regulations [3.0 Marks]
- b) What are the necessary documents that the company should provide to relevant authorities to get the approval for your plan? [2.0 Marks]

- Q3. Assume that you are engaged as a service engineer for a design of two-storey Educational building with each floor area of 20m x 12m. The ground floor will be used as a lecture theater and the upper floor is used for staff. Plan view of proposed building is shown in Figure Q3. An automatic sprinkler system is selected to install as a fire protection method in both floors. Your design should incorporate relevant travel distances according to the fire regulations. Use Data Sheet 1, 2 and 3 when answering.
- Calculate the occupant load for the ground floor of this building.
[1.0 Mark]
 - Determine the minimum exit requirement and the maximum travel distance for the ground floor.
[1.0 Mark]
 - Design a suitable arrangement for the sprinkler system for the ground floor of the building.
[3.0 Marks]
- Q4. Figure Q4 shows floor plan of a house and you are asked to design a lighting system for the house by using Lumen method. Lighting requirement is given in Table Q4 (b) in Data Sheet 4. For the lighting design, 20W Compact Fluorescent lights (CFL) are to be used in a ceiling recessed light fixture with one lamp per fixture. The luminous flux produced by lamp is 1250 initial lumens and SHRmax is 1:1. You may consider ceiling/wall/surface reflections for living area, kitchen and bedrooms as 50%/50%/30% and 50%30%10 for the bathroom. Consider the mounting height as 2.5 m. You may use Table Q4(a) and Table Q4 (c) in Data Sheet 4 as reference.
- Calculate the minimum number of luminaires required to maintain the required illuminance. Consider light loss factor (LLF) as 0.90.
[2.0 Marks]
 - Discuss the suitability of the number of lamps obtained for an acceptable uniformity. Providing necessary calculations and draw the locations of each light point on the floor plan indicating the dimensions of spaces.
[3.0 Marks]

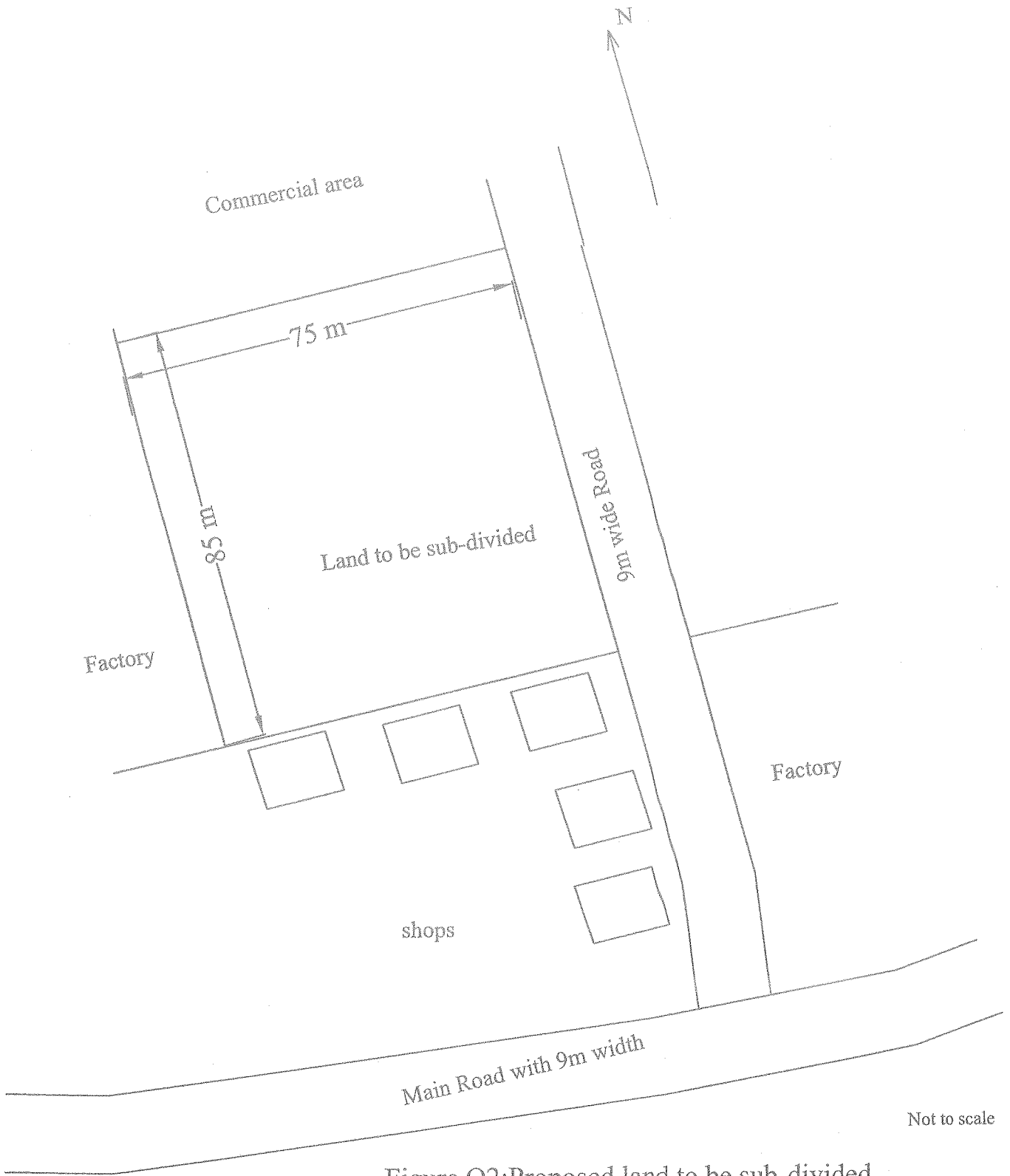


Figure Q2: Proposed land to be sub-divided

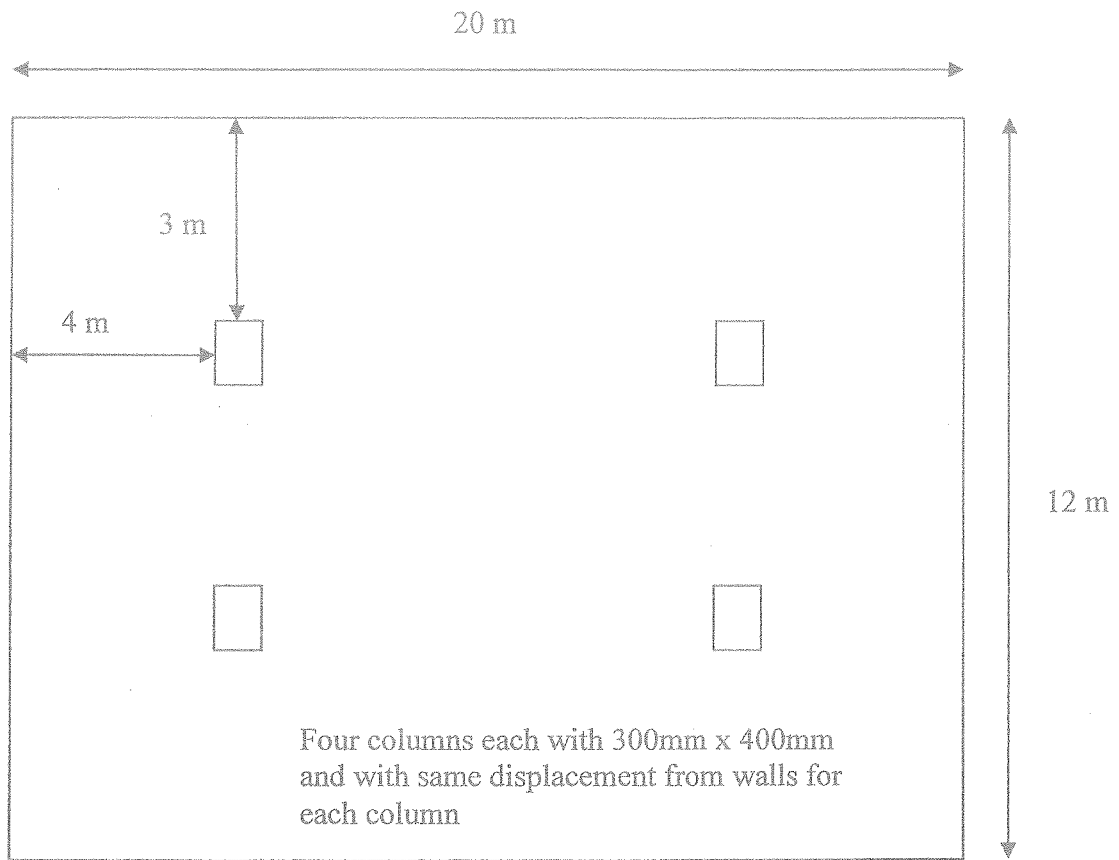


Figure Q3: Ground Floor Plan of the Proposed Educational Building

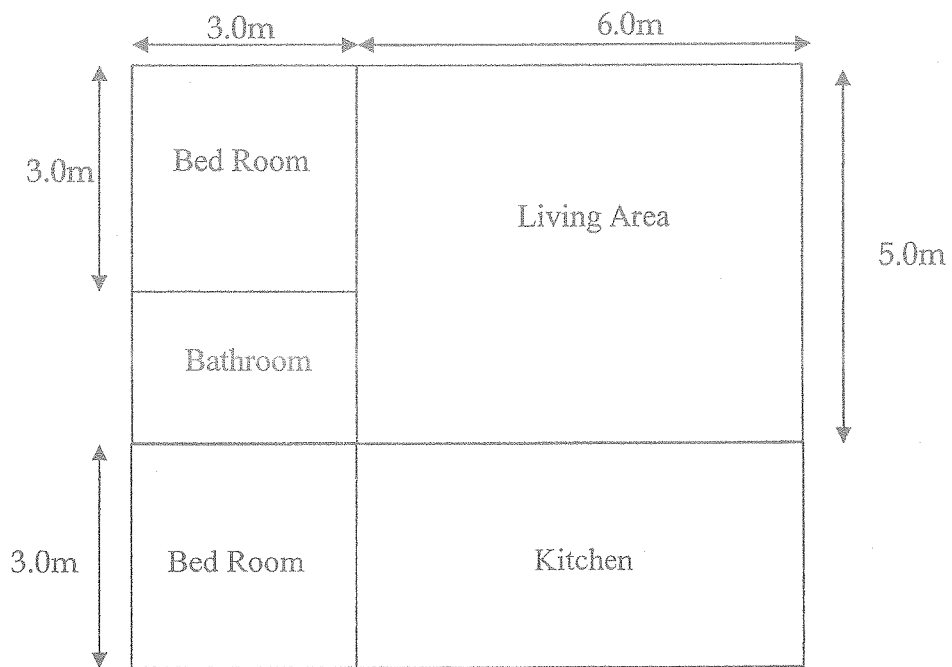


Figure Q4: Dimensions of the House

Sprinkler arrangements

S= design spacing of sprinkler on range pipes {
Max. 4.6 m extra light hazard
Max. 4.0 m ordinary hazard
Max. 3.7 m extra high hazard

D= distance between rows of sprinklers

S x D = {
21 m² or less, extra light hazard
12 m² or less, ordinary hazard
9 m² or less, extra high hazard

Classification of occupancies

Extra light hazard

Hospitals, hotels, libraries, museums, nursing homes, offices, prisons, schools, colleges

Ordinary hazard (Group I)

Butchers, breweries, cement works, cafes

Ordinary hazard (Group II)

Bakeries, chemical works (ordinary), engineering works, laundries, garages, potteries, shops

Ordinary hazard (Group III)

Aircraft factories (excluding hangars), boot and shoe factories, carpet factories, clothing factories, departmental stores, plastic factories, printing rooms, saw mills, warehouses

Group III (Special)

Cotton mills, distillers, film and television studios, match factories

Extra high hazard

Celluloid works, foam plastics and rubber factories, paint and varnish factories, wood and wood works, high piled storage risks, oil flammable liquid hazard

Note: Sprinklers must not be placed within 600mm of columns or beams.

Data Sheet 2

Table 1: Occupant Loads

Intended use or type of occupancy of the room or storey of the building	Areas of occupied floor space per person
Places of public resort not otherwise provided for in this table	1
Dance halls (calculated on dancing area)	1
Restaurants	1.5
Public lounges and hotel lobbies (calculated on usable area)	2.5
Shops and showrooms (calculated on usable area)	5
Offices, hotel service areas (calculated on usable area)	10
Dormitories and self-contained single room flats (calculated on living area)	3
Apartments and flats (calculated on living area)	15
Schools	1.5
Warehouses, godowns, bulk storage, public garages and motor showrooms	28
Hospitals	7.5

Extracted from Table 72A of Fire Regulations published by ICTAD (Publication No. ICTAD/DEV/14, May 1997)

Table 2: Exit Requirements

Type of Occupancy	Maximum Occupant load with one door
High hazard	10
Godowns, storage buildings	50
Shops, departmental stores and business premises	75
Factory building without high hazards	50
Place of public resort	75
Educational building	75
Hospitals	15
Hotels, boarding houses, hostels, residential block etc	20

Extracted from Table 72A of Fire Regulations published by ICTAD (Publication No. ICTAD/DEV/14, May 1997)

Data Sheet 3

Table 3: Travel Distance Requirements

Type of occupancy	Max. travel Distance (m)	
	Unsprinklered	Sprinklered
High hazard	20	35
Industrial buildings	30	45
Business (shops, offices etc)	45	60
Places of public resort and car parks	45	60
Schools and educational buildings	45	60
Hospitals	30	45
Hotels, boarding houses	30	45

Extracted from Table 73A of Fire Regulations published by ICTAD (Publication No. ICTAD/DEV/14, May 1997)

Table Q4 (a): Useful equations

Equation	Description
$E = \frac{n \times N \times f \times LLF \times UF}{A}$	N - Number of Luminaries E - Required illumination (lux) A - Working area (square meter) F - Luminous flux produced per lamp (lumens) n - Number of lamps in a luminaire LLF -Light Loss factor UF - Utilization factor
$Room\ Index = \frac{L \times W}{H_m(L + W)}$	L - Length of the area W -Width of the area H _m - Mounting height (m)
$SHR = \frac{1}{H_m} \sqrt{\frac{A}{N}}$	A - Working area (square meter) N - Number of Luminaries H _m - Mounting height (m)

Table Q4 (b) Lighting Requirement

Area	Required Light Level (Lux)
Living area	350
Kitchen	400
Bedroom	200
Bathroom	200

Table Q4 (c): Utilization factors for ceiling recessed luminaire

Utilization factor - Ceiling recessed luminaire										
	Reflectance									
	0.8	0.8	0.8	0.5	0.5	0.8	0.8	0.5	0.5	0.3
Ceiling	0.8	0.8	0.8	0.5	0.5	0.8	0.8	0.5	0.5	0.3
Wall	0.8	0.5	0.3	0.5	0.3	0.8	0.3	0.5	0.3	0.3
Surface	0.3	0.3	0.3	0.3	0.3	0.1	0.1	0.1	0.1	0.1
Room Index	Utilization factor (%)									
0.3	63	35	28	38	26	58	27	33	28	27
0.6	73	46	37	46	36	66	36	42	35	35
0.8	82	57	47	54	46	74	45	51	44	44
1.0	91	66	56	62	54	80	53	59	52	51
1.5	98	75	65	70	62	85	61	66	60	59
2.0	103	82	73	76	69	89	67	72	66	65
2.5	109	91	82	84	78	94	75	78	73	72