UNIVERSITY OF RUHUNA

Faculty of Engineering

End-Semester 8 Examination in Engineering: December 2015

Module Number: EE8236 **Module Name: Electrical Systems in Buildings**

[Three Hours]

[Answer **all questions**, each question carries **10 marks**]
[All the lecture notes and the hand written notes are allowed to use during the exam.]
[No text books are allowed.]

Q1 a) Compare the Terra-Terra (TT) earthing system and the Terra-Neutral (TN) earthing system in terms of the earth loop impedance and the earth fault current.

[1 Mark]

b) Explain briefly why it is usually necessary to use a Residual Current Device (RCD) to protect against indirect contact in a TT system, but not in a TN earthing system.

[1 Mark]

c) Why does a Miniature Circuit Breaker (MCB) have both a bi-metallic trip element as well as an electromagnetic trip element?

[2 Marks]

d) It is found that a certain TN-C-S installation have following details,

Transformer(Dy11) winding resistance referred to secondary side = 0.001 Ω/phase
Phase conductors of main supply = 35 mm² Cu/PVC/PVC
Neutral conductors of main supply = 35 mm² Cu/PVC/PVC
Phase conductors within installation = 25 mm² Cu/PVC/PVC
Neutral conductors within installation = 25 mm² Cu/PVC/PVC
Source earth electrode resistance = 2.5 Ω
Distance from Main Distribution Board(MDB) to 3 Phase load = 20 m
Distance from source to installation MDB = 50 m
Main cable installation method = In conduit
Cable installation method within installation = In conduit

By considering the worst case, calculate the maximum possible earth fault current at the load terminals. State any assumptions you made.

[2 Marks]

e) Explain why you may not be able to barehanded pull to safety, a person undergoing an electric shock who is unable to let go by himself. What alternate method would you suggest?

[2 Marks]

f) List and describe the electrical instrument you use in the following situations.

i) Need to check the live and neutral of 230 V/AC copper conductors.
ii) Need to check the + and - of 24 V/DC copper conductors.
iii) Need to check a High Rupture Capacity (HRC) fuse.
iv) Need to check the insulation level of a single phase circuit.

[2 Marks]

Q2 a) A 400 V, 50 Hz, 3-phase circuit is to be run in 100 m long, 4C, Cu/PVC/XLPE/PVC cable on cable tray. The circuit, with a design load of 365 A at a power factor of 0.95 lagging, is to be protected against overload and short circuit. The maximum ambient temperature is 40°C. Determine the followings.

i) The minimum cross-sectional area of the live conductor.
ii) Voltage drop in the cable.
iii) Cross-section of circuit protective conductor. State any assumptions you made.
iv) Suitable circuit breaker capacity and type.

[4.5 Marks]

b) What are the factors you need to consider when selecting a cable for a task?

[1 Mark]

c) Some of the devices are omitted from protection against overload. Explain with two suitable examples.

[2 Marks]

d) Compare the followings.

i) Earth Leakage Relay (ELR) vs RCD
ii) Moulded Case Circuit Breaker (MCCB) vs MCB
iii) Metal Halide lamp vs Light Emitting Diode (LED) lamp
iv) E27 Holder vs B22 Holder
v) Copper conductor vs Aluminium conductor

[2.5 Marks]

Q3 a) What do you understand by correlated colour temperature (CCT) of a light source? The CCT of a fluorescent lamp is specified as 6500 K. What colour of light do you expect from this lamp?

[1 Mark]

b) A Hospital building layout drawing is shown in Figure 1 and needs to be illuminated for required lux level using fluorescent light of an efficacy of 70 lm/W. It is known that 30% of the light produced is lost within the fixture and another 25% margin is to be allowed for loss due to aging.

i) If fluorescent light fitting of rating 4 x 14 W are to be used, how many lamps do you need to obtain the recommended illumination?
ii) Draw a suitable layout arrangement of the distribution of the lamps on the ceiling.

iii) Calculate the maximum current required for each lamp fitting. Clearly mention the assumptions you made.
iv) Select the suitable cables (>1mm^2), switches, MCB, RCD and voltage drop.
v) Draw a suitable line diagram considering light loads.
vi) Prepare a rough cost estimate for the above work.

[9 Marks]

Q4 a) Draw a labeled typical setup of a Digital Closed Circuit Television (CCTV) system. What are the advantages and the disadvantages of Digital CCTV system over the Analog CCTV system?

[1.5 Marks]

b) Briefly explain the purpose of a CCTV system with four suitable examples.

[1 Mark]

c) List the factors which need to be considered when buying CCTV cameras and describe the two most important aspects.

[1 Mark]

d) What are the steps and procedures you need to follow when designing a CCTV system?

[1 Mark]

e) What is the purpose of a Car Park Management System? List the main components of a Car Park Management System.

[1.5 Marks]

f) Describe the main functions of a PABX system and list the main components in a PABX system.

[1.5 Marks]

g) Briefly describe the followings.

i) CAT 6 Cable
ii) VoIP
iii) Telephone jacks and outlets
iv) Video balun
v) PTZ camera

[2.5 Marks]

Q5 a) Why earthing or grounding is important in an electrical system of a building? Support your answer with suitable examples.

[2 Marks]

b) A class 1 type lightning protection system needs to be installed in a building. The drawings of the building are given in Figure 2 and Figure 3. Propose a suitable design to protect the building from lightning. Clearly mention the basics of lightning protection.

[2.5 Marks]

c) Air conditioning process involves in maintaining and controlling of several parameters. List these parameters.

[1.5 Marks]

d) Do you think that DX-single split type air conditioner can achieve the ASHRAE standard? Justify your answer.

[1.5 Marks]

e) Explain a central air conditioning system in detail using clearly labeled sketches.

[1.5 Marks]

f) What are the advantages of Building Management System (BMS)?

[1 Mark]

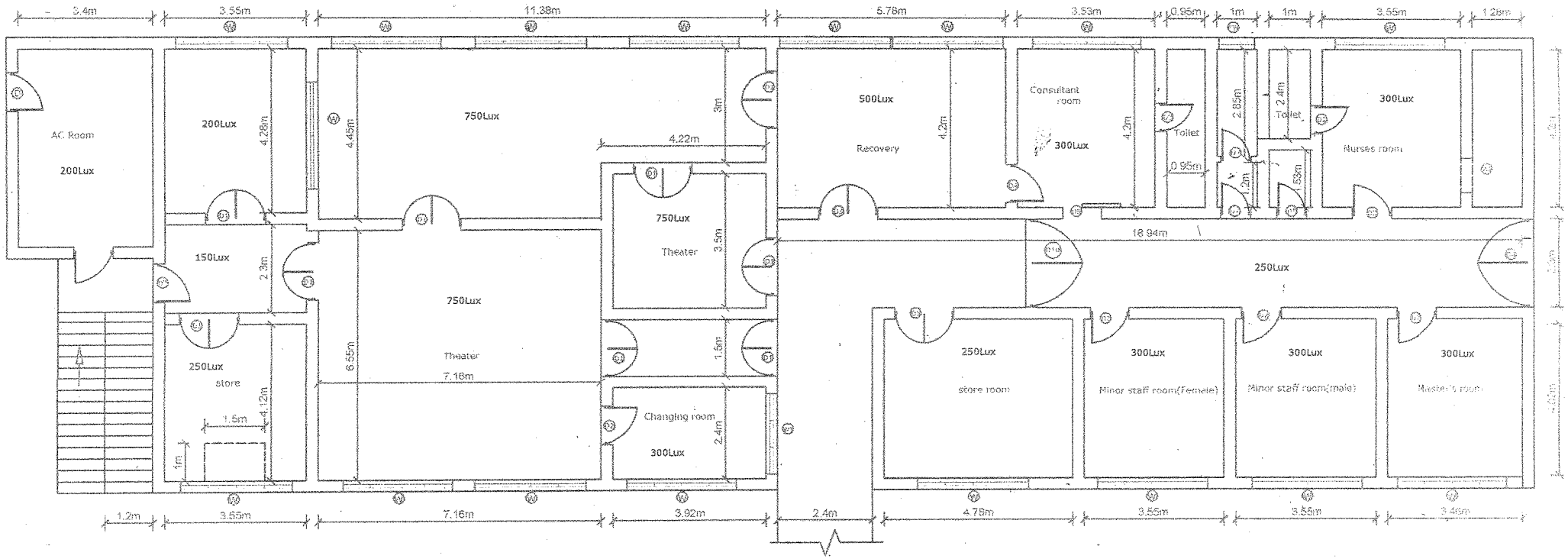

3.4m
3.55m
11.38m
5.78m
3.53m
0.95m
1m
1m
3.55m
1.28m
AC Room
200Lux
200Lux
4.28m
150Lux
2.3m
250Lux
store
1.5m
4.12m
1m
4.45m
750Lux
3m
4.22m
750Lux
Theater
3.5m
750Lux
Theater
7.16m
6.55m
1.5m
Changing room
300Lux
2.4m
500Lux
Recovery
4.2m
Consultant room
300Lux
4.2m
Toilet
0.95m
2.85m
1.2m
2.4m
Toilet
.53m
300Lux
Nurses room
18.94m
250Lux
250Lux
store room
300Lux
Minor staff room(Female)
300Lux
Minor staff room(male)
300Lux
1.2m
3.65m
7.16m
3.92m
2.4m
4.78m
3.55m
3.55m
3.46m

Figure 1

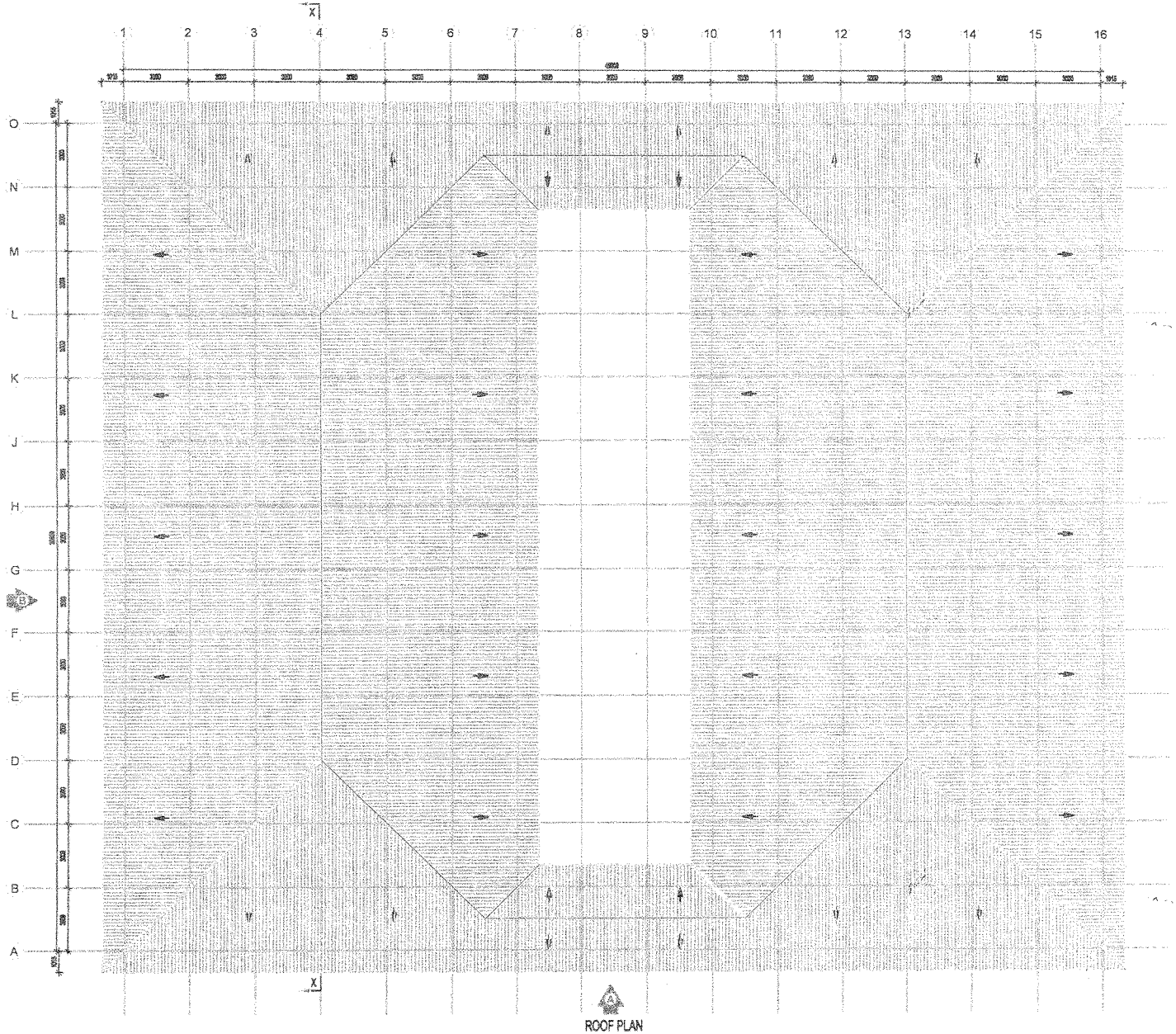
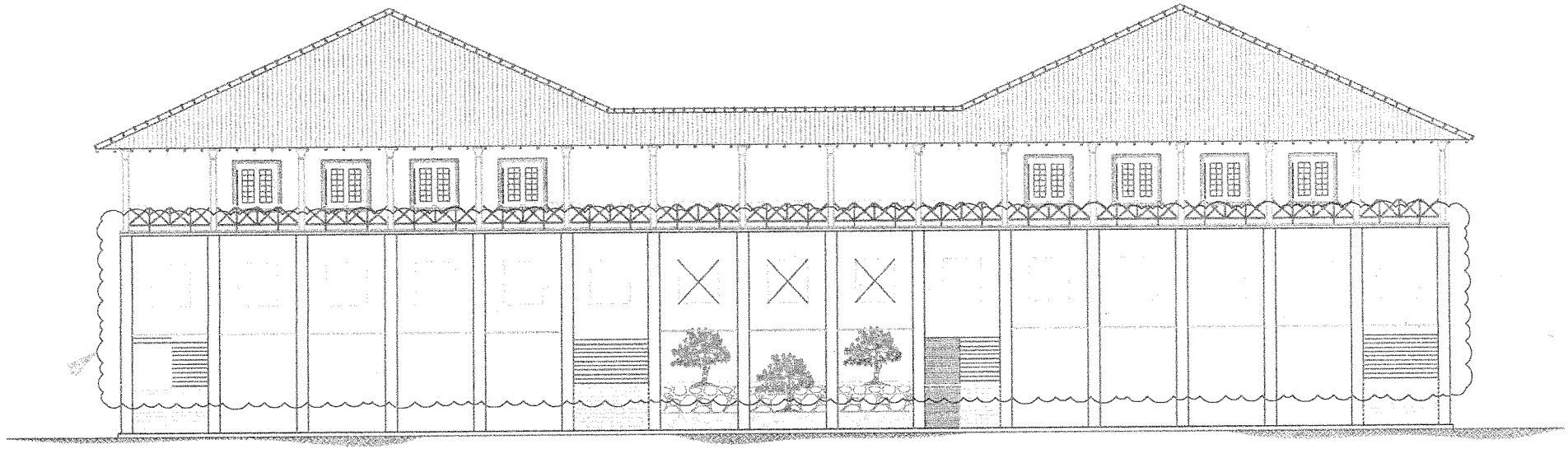


Figure 2



ELEVATION - A

Figure 3