



UNIVERSITY OF RUHUNA

Faculty of Engineering

End-Semester 8 Examination in Engineering: December 2018

Module Number: EE8202

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) i) Discuss the advantages and the disadvantages of overhead lines compared to underground lines.
ii) Name the cable insulating materials and discuss the advantages and the disadvantages of them.

[3.0 Marks]

- b) The layout drawing of a marine engineering workshop is shown in Figure 01. The workshop is equipped with a 15 kW, 3-phase lathe machine operating at 0.8 power factor lagging. The height from the lathe machine's motor to cable tray and height from floor distribution board (FDB) to cable tray are 2.5 m and 1.5 m, respectively. Take the ambient temperature as 38°C and calculate the following. State any assumptions you have made.

- i) Correction factors considering 4-core thermosetting cables
ii) The minimum cross-sectional area of the live conductor
iii) The voltage drop in the cable
iv) Cross-sectional area of the circuit protective conductor
v) Capacity and the type of a suitable circuit breaker for the lathe machine

[7.0 Marks]

Q2.

- a) i) Describe the advantages and the disadvantages of the Internet Protocol (IP) related systems in modern buildings.
ii) Explain the advantages of having a Building Management System (BMS) in a building.

[4.0 Marks]

- b) Consider the layout drawing of marine engineering workshop shown in Figure 01. A suitable closed-circuit television (CCTV) camera system needs to be designed to cover all the critical areas of the workshop.
- i) Propose a suitable CCTV camera system for selected locations by clearly marking on Figure 01. Mention the camera type, IP ratings, rough focal length, covering area and view angle.
 - ii) Draw a schematic CCTV diagram with digital video recorder (DVR), monitor, cables and cameras.

[6.0 Marks]

Q3.

Consider the layout drawing of marine engineering workshop shown in Figure 01. A suitable lighting system needs to be designed for this workshop using lights having efficacy of 90 lm/W. Required lux levels in each floor area are given in the Figure 01. Take the utilization factor as 0.8 and maintenance factor as 0.75. Following lamp fittings are available.

- LED tube, 1x18W , 1200 mm lamp fitting
 - LED tube, 2x18W , 1200 mm lamp fitting
 - LED tube, 1x10W, 600mm lamp fitting
 - LED panel light, 6W, 300 mm x 300 mm
 - LED panel light, 12W, 300 mm x 300 mm
 - LED panel light, 50W, 600 mm x 600 mm
 - LED indoor wall light, 7W
 - LED outdoor wall light, 7W, IP65
- a) Select the suitable lamp fittings and calculate the number of lamp fittings to achieve the required lux level.
- [2.0 Marks]
- b) Design the lighting layout for the distribution of the lamps on the workshop ceiling. Use the Figure 01 to draw the lighting layout.
- [2.5 Marks]
- c) Draw a suitable layout arrangement for power sockets, ceiling fans and exhaust fans.
- [1.5 Marks]
- d) Draw a suitable line diagram for lighting, power sockets and lathe machine. Mention all the important details in the diagram.
- [2.0 Marks]
- e) Prepare a rough bill of quantities (BOQ) for the above work.
- [2.0 Marks]

Q4.

- a) i) Explain why Miniature Circuit Breaker (MCB) is an essential protective device for an electrical installation.
- ii) Explain why it is necessary to incorporate sensitive protective devices such as Residual Current Devices (RCDs) at consumer installation for Terra-Terra (TT) earthing system. Use suitable figures to illustrate your answer. [3.0 Marks]
- b) Write brief notes on following.
- i) Consideration of diversity factor and utilization factor in power demand calculations.
- ii) Applications in which protective devices are omitted in an electrical installation. [2.0 Marks]
- c) Determine the power requirement of a small shop which has following loads. Use relevant factors for your calculation and clearly mention any assumptions you have made.
- Four number of 5 kW, 3-phase cookers
 - Two number of 2 kW, 3-phase water heaters
 - Five number of 13 A sockets
 - Thirty number of twin 28 W fluorescent lamps with electronic ballasts
- [5.0 Marks]

Q5.

- a) Explain why all metal pipes, steel roof structures and steel hand rails should be connected to the earth terminal of the building. [2.0 Marks]
- b) State the advantages and the disadvantages of an isolated lightning protection system compared to a non- isolated lightning protection system. [2.0 Marks]
- c) The elevation layout, the section layout and the roof layout of a building are shown in Figure 02-a, Figure 02-b and Figure 02-c, respectively. Design a suitable lightning protection system considering Class 1 protection level. Air termination system, earthing systems, down conductors, required size of all the materials and other relevant information should be clearly mentioned in the above mentioned figures appropriately and submit with your answer script. Use copper as the conducting material. State any assumptions you have made. [6.0 Marks]