



6. A small shop within a shopping mall is to be supplied from a 230V supply 50Hz supply. The total calculated load for this shop was found to be 6 kW and the power factor was assumed to be 0.85 lagging. The cable supplying this shop is to be protected by a BS 88 Part 2 fuse.

The measured distance from the nearest distribution board to the shop was found to be 60m. The cables used to supply the shop are to be single core cables, PVC insulated, installed in steel trunking with three similar circuits. Assume an ambient temperature of 35°C and that the voltage drop in the cables is limited to 2.5%.

Using the below tables and ignoring any diversity, calculate:

- (i) the full load current required for the workshop ( $I_L$ ) (4 marks)
- (ii) the rating of the fuse ( $I_n$ ) (4 marks)
- (iii) minimum current rating of cables (4 marks)
- (iv) Minimum cable c.s.a. (4 marks)
- (v) actual voltages drop in the cable. (4 marks)

Refer to Tables 6.1 to 6.4

6A	10A	16A	20A	32A	50A
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No of Circuits	1	2	3	4	5	6	7
$C_g$	1.0	0.8	0.7	0.65	0.6	0.57	0.54

Ambient temperature (°C)	25	30	35	40	45	50	55	60
$C_a$	1.03	1.0	0.94	0.87	0.79	0.71	0.61	0.50

Cross Sectional Area mm <sup>2</sup>	Current carrying capacity (A)	Voltage drop mV/A/m
1	13.5	38
1.5	17.5	25
2.5	24	15
4	32	9.5
6	41	6.4
10	57	3.8
16	76	2.4

## EXAMINATION FOR AUTHORISATION A

Paper 2: Electrical Installation Technology

Date: 3 February 2021

Time: 15:00 – 18:00 (Three hours)

END OF EXAMINATION PAPER

This examination paper contains six questions. Candidates are requested to answer any FIVE (5) questions. Candidates are also requested to include all their work in the booklet provided. Every answer should include all workings, any necessary diagrams and formulae. Use a fresh page for each different question. Each question carries 20 marks.

1. The installation cables of a small supermarket are to be run in plastic trunking. In a particular part of the installation, the following cables are to be run in the same trunking:

1.5 mm<sup>2</sup> cables = 12  
 2.5 mm<sup>2</sup> cables = 9  
 4 mm<sup>2</sup> cables = 6  
 25 mm<sup>2</sup> cables = 3  
 50 mm<sup>2</sup> cables = 3

Using the two tables below, choose the best and most economical size of trunking keeping in mind that the regulations require that you keep a space-factor of 45%.

Show all your working when answering this question. **(20 marks)**

Details of single-core p.v.c.-insulated cables

Cable size	Nominal conductor size (mm <sup>2</sup> )	Number and diameter of wires (no./mm)	Nominal overall diameter (mm)
1.0	1.0	1/1.13	2.9
1.5	1.5	1/1.38	3.1
2.5	2.5	1/1.78	3.5
2.5	2.5	7/0.67	3.8
4	4	7/0.85	4.3
6	6	7/1.04	4.9
10	10	7/1.35	6.2
16	16	7/1.70	7.3
25	25	7/2.14	9.0
35	35	19/1.53	10.3
50	50	19/1.78	12.0

Dimensions of trunking (mm x mm)

50 x 37.5
50 x 50
75 x 25
75 x 37.5
75 x 50
75 x 75
100 x 25
100 x 37.5
100 x 50
100 x 75
100 x 100

2. (a) Fluorescent lamp circuits frequently have two capacitors fitted. What is the function of each capacitor? **(4 marks)**
- (b) Draw a clear and well-labelled diagram of a fluorescent lamp circuit showing clearly all the components of the circuit including the two capacitors mentioned above. **(8 marks)**
- (c) On the market there are three types of intermediate switches. Each type has different connection positions. Draw a clear and well-labelled wiring diagram of a circuit showing five lamps all controlled from three positions. Show on your diagram the connection positions of the type of intermediate switch that you use. **(8 marks)**

3. (a) The full-load rating of a 230 V cooker is 11.5 kW and the control unit protecting the cooker incorporates a socket outlet. Using the table provided below, calculate the Assumed Current Demand.

the first 10 A of the total rated current of the connected cooking appliance
plus 30% of the remainder of the total rated current of the connected appliance
plus 5 A if there is a socket outlet in the control unit.

**(8 marks)**

- (b) The following devices offer protection from overcurrent. Using a diagram describe each of the devices below:

- (i) semi-enclosed fuses manufactured to BS 3036,  
 (ii) cartridge fuses manufactured to BS 1361 and BS 1362,  
 (iii) high breaking capacity fuses (HBC fuses) manufactured to BS 88,  
 (iv) miniature circuit breakers (MCBs) manufactured to BS 3871.

**(12 marks)**

4. (a) When an electrical installation is finished a number of tests are carried out. List the sequence of tests required:

- (i) before the supply is connected **(5 marks)**  
 (ii) with the supply connected **(4 marks)**

- (b) List four types of instruments that are commonly used to test electrical installations. **(4 marks)**

- (c) Consider a shell single bedroom flat, having a combined kitchen and a dining room, a bathroom, a living area and a small study room. As an electrician you are assigned to carry out the Electrical Installation work. Develop a general 'Bill of Quantities' for the above single bedroom flat.

Note: You are not required to give exact quantities, just a general list.

**(7 marks)**

5. (a) What is meant by the following terms related to an electrical installation:

- (i) Exposed Conductive Parts **(2 marks)**  
 (ii) Extraneous Conductive Parts **(2 marks)**  
 (iii) Circuit Protective Conductor **(2 marks)**  
 (iv) Earthing Conductor. **(2 marks)**

- (b) Why is a residual current device (RCD) required? **(5 marks)**

- (c) With the aid of a diagram explain the operation of a single-phase Residual Current Device (RCD). **(7 marks)**