



4. Each Phase of a delta-connected load comprises of a resistance of 40Ω and an $80\mu\text{F}$ capacitor in series. The load is connected to a 400V, 50Hz 3-phase supply.
- (a) Draw a diagram showing the Delta connected load. **(2 marks)**
 - (b) Calculate:
 - i) The phase current **(5 marks)**
 - ii) The line current **(3 marks)**
 - iii) The total power dissipated **(3 marks)**
 - iv) The kVA rating of the load. **(2 marks)**
 - (c) Draw a phasor diagram for the load. **(5 marks)**
5. (a) Mention **four** construction site examples where temporary installations are regulated by the IET Wiring Regulations. **(4 marks)**
- (b) Explain **three** main requirements for a temporary electrical installation in a construction site as regulated by the Electricity Installation Regulations S.L.545.24. **(9 marks)**
- (c) Explain the requirements of site documentation and labelling for a construction site. **(4 marks)**
- (d) Describe a planned routine maintenance for the construction site electrical installation. **(3 marks)**
6. (a) Explain the operation of a current transformer and state why such current transformers are required. **(6 marks)**
- (b) A medium size factor is to have a peak load of 130kW at a power factor of 0.75 lagging.
- i. Calculate the load current and recommend a CT ratio to be installed and the main distribution board. **(4 marks)**
 - ii. Draw a circuit diagram for the main distribution board to be able to read current, voltage, real and reactive power, power factor and energy. **(10 marks)**

EXAMINATION FOR AUTHORISATION B

Paper 2

Date: 7th July 2023

Time: 9:00 – 12:00 (Three hours)

END OF EXAMINATION PAPER

This examination paper includes six questions. Candidates are requested to answer any FIVE (5) questions showing 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. (a) State the **two** reasons for overcurrent. **(2 marks)**
- (b) Describe each of the above causes for overcurrent. Give **three** examples for each overcurrent situation stated in 1 (a). **(10 marks)**
- (c) Explain why the two conditions are quite different. **(4 marks)**
- (d) Are the two conditions protected by one common device? **(2 marks)**
- (e) State typical protective devices that could be used. **(2 marks)**
2. (a) A cooker consists of the following elements fed from a cooker control unit which incorporates also a 13 A socket. The cooker elements are:
- 4 x 2.5 kW fast-boiling rings
 - 1 x 3 kW oven
 - 1 x 2 kW grill

The supply voltage is 230 V, 50 Hz. Calculate the cable carrying amperes for the above cooker applying the diversity factors according to IET Regulations to be used safely. **(5 marks)**

- (b) An electrician has been given the task of a shop with the following single-phase loads, which are balanced as evenly as possible across the 415 V three-phase supply.
- 2 x 5.5 kW and 7 x 2.5 kW thermostatically controlled water heaters
 - 2 x 3 kW instantaneous water heaters
 - 2 x 5 kW and 1 x 4 kW cookers
 - 12 kW of discharge lighting (Sum of tube ratings)
 - 8 x 30 A ring circuits feeding 13 A sockets.

Calculations should be based on (Table 2.1).

All loads with the exception of the discharge lighting can be assumed to be at unity power factor and a perfect balance three phase.

- (a) What is the single-phase voltage for the 415 V three-phase system supply? **(1 mark)**

Calculate;

- (b) the current per kilowatt **(1 mark)**
- (c) the total demand of the system, assuming that diversity can be applied. **(13 marks)**

Table 2.1 - Allowance for diversity

Note the following abbreviations :

X is the full load current of the largest appliance or circuit

Y is the full load current of the second largest appliance or circuit

Z is the full load current of the remaining appliances or circuits

Type of final circuit	Type of premises		
	Households	Small shops, stores, offices	Hotels, guest houses
Lighting	66% total demand	90% total demand	75% total demand
Heating and power	100% up to 10 A + 50% balance	100%X + 75%(Y+Z)	100%X + 80%Y + 60%Z
Cookers	10 A + 30% balance + 5 A for socket	100%X + 80%Y + 60%Z	100%X + 80%Y + 60%Z
Motors (but not lifts)		100%X + 80%Y + 60%Z	100%X + 50%(Y+Z)
Instantaneous water heaters	100%X + 100%Y + 25%Z	100%X + 100%Y + 25%Z	100%X + 100%Y + 25%Z
Thermostatic water heaters	100%	100%	100%
Floor warming installations	100%	100%	100%
Thermal storage heating	100%	100%	100%
Standard circuits	100%X + 40%(Y+Z)	100%X + 50%(Y+Z)	100%X + 50%(Y+Z)
Sockets and stationary equip.	100%X + 40%(Y+Z)	100%X + 75%(Y+Z)	100%X + 75%Y + 40%Z

3. A coil of resistance 70Ω and inductance 318.4mH is connected in parallel with a 15μF capacitor across a 400V, 50Hz supply.

a) Calculate;

- i. the current in the coil **(2 marks)**
- ii. the current in the capacitor **(2 marks)**
- iii. the supply current and its phase angle **(4 marks)**
- iv. the circuit impedance **(3 marks)**
- v. the power consumed **(3 marks)**
- vi. the apparent power **(2 marks)**
- vii. the reactive power. **(2 marks)**

b) Sketch a phasor diagram. **(2 marks)**