COLLEGE OF ENGINEERING, SCIENCE & TECHNOLOGY

SCHOOL OF ELECTRICAL ENGINEERING & ELECTRONICS ENGINEERING

CERTIFICATE 4 IN ELECTRICAL ENGINEERING – STAGE 4

EEE 445 ELECTRICAL INSTALLATION TECHNOLOGY 2

FINAL EXAMINATION SOLUTIONS – PENSTER 2, 2014

[SOLUTIONS]

C4EL4, EEE 445 – ELECTRICAL ISTALLATION TECHNOLOGY 2- PENSTER 2 [2014]

SECTION A (40 MARKS) BRIEF ANSWERS.

ANSWERS:

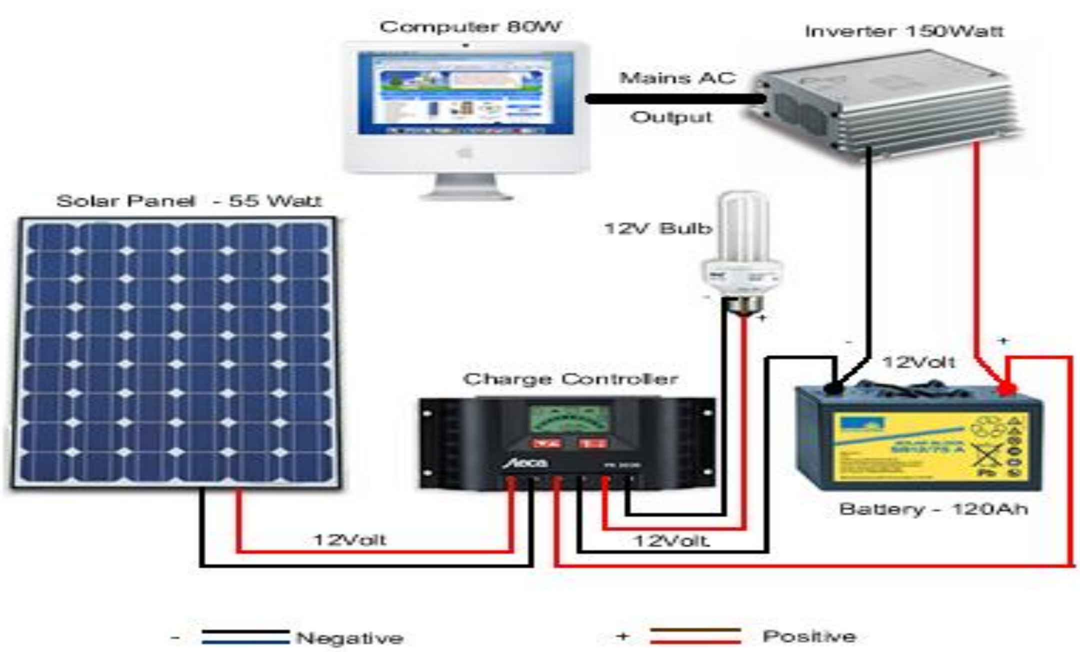
1. Rule no. 3. 9. 4. 6 – Protection methods.
   a. Provided with adequate mechanical protection to prevent damage; or
   b. Provided with and earthed metallic armoring screen covering a enclosure or
   c. Protected by an RCD with a maximum rated residual current of 30 mA.

(4 marks)

2. Rule no. 7. 7. 11 – Plugs and socket-outlets for SELV and PELV
   a. Plugs shall not able to enter socket-outlets of other voltage systems.
   b. Socket-outlets shall not accept plugs of other voltage systems.
   c. Socket-outlets shall not have a contact for a protective earthing conductor.

(4 marks)

3.a. Solar power:



3.b. The power from the solar panels and charges the battery in a precisely controlled way. Not too much if it's full and plenty of power if it's low in charge. Batteries can be expensive so it's worth having something that looks after them!

The diagram also shows an inverter attached to the battery. The inverter converts the battery voltage into mains voltage so you can run things like computers, lighting or other mains voltage appliances from the solar power stored in the battery.

Some solar panel charge controllers have a low voltage DC output where you can connect 12 or 24 volt lighting. This output is regulated by the controller so if it senses that the battery is running low it automatically turns this output off to protect the battery from being damaged by deep discharge. (8 marks)

4. Rule no.1. 11. 1
   a. Inspected as far as reasonably practicable:
      Visually inspect the installation completely and the following standards should be met. Right cable sizes, proper installation methods, number of points per circuit are correct, protective devices correspond well with final sub-circuits, final sub-circuits are well protected, switch-board and protective devices should be safely terminated and MEN system adhered to.

   b. Tested:
      The installation is tested using an isulationmegger testertotestinsulation resistance for all final sub-circuits.
      An earth megger tester is used to test the earth continuity and resistivity to mass earth.
      A multimeter is used to test for polarity and continuity for final sub-circuits.

(6 marks)

5. Rule no. 1. 11. 2
   a. **Continuity of earth system:** Electrodes are used for better connection to mass earth. Earth connections are usually bonded by soldering earth joints.

   b. **Insulation resistance:**Megger insulation tester is used to test the dielectric strength of the cable insulation. 1 MΩ is the required resistance between live and earth parts of an electrical installation.

   c. **Correct polarity:**Termination of cables to final electrical points should have their polarities right. Wrong polarity causes damage to equipment as well as short- circuit to cable. There is no transposition of conductors that could result in the equipment unsafe when connected to the supply.

   d. **Correct circuit connections:**Final sub-circuits should be terminated at their respected points as well as to their protective devices must correspond to that particular circuit. Example, light circuits cannot be teed off the power circuit or vice-versa.

   e. **Operation of residual devices (RCDs**): RCDs and ELCBs are the recommended protective devices to be used on all or to control CBs for final sub-circuits in any domestic and commercial installation for protection to people and equipment and trip at a very low current value, 30 mA.
      Verified to be of the type providing protection against residual alternating current and residual pulsating D.C. and caused to operate by tests carried out on the protected circuit.

(10 marks)

6. a. Rule no. 2. 8. 3. 4. 2

Sub mains and final sub circuits greater 100 Amperes per phase shall be controlledby a separate isolating switch onthe switch board by which the circuit originates.

6. b. Rule no. 2. 8. 3. 4. 3

A standby generator for building "B" shall be controlled by an isolation switch at the sourceof supply or at the switch board.

6. c. Rule no. 2. 8. 3. 4. 4

Warning notices and markings with suitable wordings to clearly identify the circuit isolated where for any reason the isolation device could not be isolated in a distribution board or a switch gear assembly. (8 marks)

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SECTION B (40 MARKS) PROBLEM ANSWERS.

1. Maximum Demand: (total: 15 marks)

➢ Lighting points:		
Lights	30	
Lighting track (15 × 2)	30	
2 × 40 W exhaust fans	2	
	62 points	9 Amperes
➢ Socket-outlets:		
10 A single (8× 1)	8	
1. double (6 × 2)	12	
	20 points	10 Amperes
➢ 15 A socket outlet	1 point	10 Amperes
➢ 7 kW range	50% connected load	14.6 Amperes
➢ 5.2 kW Storage W/heater	Full connected load	21.6 Amperes
➢ 4 kW tennis court light	75% connected load	12.5 Amperes
	MAXIMUM DEMAND:	**77.7 AMPERES**

2. a. Total power: (total: marks 25)

$10\ H.p. \times 746\ W = 7.46\ kW$ (2 marks)

2. b. $F.L.current: P = \sqrt{3} V_L I_L cos\emptyset$

$= {}^{7460}/_{\sqrt{3} \times 415 \times 0.85}$

$I = 12.2\ Amperes$ (3 marks)

2. c. Supply cable size= $1.45 \times I_N = 1.45 \times 16\ Amps = 23.2\ Amperes$

$Ia = type\ B = 4\ times\ rated\ current$

$= 23.2 \times 4$

$= 92.8\ Amperes$

$Recommended\ Circuit\ Breaker$: $\mathbf{100\ Amperes}rating\ 3\emptyset\ at$ Main switch-board

$Cable\ size = 12.2\ Amperesrated\ current \times 4\ times\ rated\ current, I_N = \mathbf{50\ Amperes}$

$\mathbf{Cable\ size = 10\ mm^2}$ (4 marks)

2. d. Cable protection:

Rule no. 3. 11. 1, column 1, table 3.6=Insulated cable (sheathed) PVC/PVC.

Column 8, table 3.6=buried directly underground. (3 marks)

2.e. Rule no. 4.3.4.1, 4.3.4.2Motor protection against overload and over temperature. (3 marks)

2. f. Rule no. 3.11.3.2 category A and the depth is not less than 0.5 meter underground, table 3.7 (3 marks)

2. g. Rule no. 4.2.1.1 Devices for isolating and switching rotating machinery (motor) (3 marks)

2. h. Rule no. 2.4.3.2

F.L. current of motor= 12.2 Amps $\times 4\ rated\ current = 48.8\ Amps$

$I_N = 50\ Ampere\ circuit\ breaker\ protecting\ the\ motor\ and\ 100\ Ampere\ (refer\ to\ part\ to\ 2.c.)$

Cont….

$For\ the\ main - switch\ at\ the\ main\ switchboard.$ (4 marks)

C4EL4, EEE 445 – ELECTRICAL INSTALLATION TECHNOLOGY 2 – PENSTER 2 [2014]Type equation here.

SECTION C (20 MARKS) SHORT ANSWERS.

1. Rule no. 2.4.2.

a) Circuit- breaker incorporating short-circuit and overload releases.
b) Circuit- breaker fuse combinations. (3 marks)

2. Rule no. 7.9.2.2 (a) & (b)

Two general hazardous areas are recognized as follows:

a) Gas hazardous areas Gas hazardous are those in which flammable gases or vapours are or may be present in the area in sufficient quantities to produce an explosive gas atmosphere.
b) Dust hazardous areas Dust hazardous areas are those areas which are hazardous because of the presence of combustible dust, fibres or flyings. (3 marks)

3. Rule no. 3.10.2

Name three types only of wiring enclosures

a) Steel conduit or other metallic tubing or conduit.
b) Rigid and flexible non-metallic conduit.
c) Flexible metallic conduit. (3 marks)

4. Rule no.1.8.1. (a), (b) and (c)

a) Protection of persons, livestock and property from harmful effects.
b) Correct functioning of the electrical installation for the use intended.
c) Compatibility with electricity distribution system, or other source of supply, to which the electrical installation is to be connected. (4 marks)

5. Rule no.5.6.2.2

a) Rods or pipes
b) Tapes or wires
c) Metallic reinforcement of concrete foundations embedded in the earth. (3 marks)

6. Rule no.6.3.3.3.1

$1000\,V = 10M\Omega$

$500V = 1M\Omega$ (4 marks)